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ECONOMIC AFFAIRS

No. 1050

EKO: ECONOMICS AND ORGANIZATION
OF INDUSTRIAL PRODUCTION

No. 1, January 1983

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ECONOMIC DATA ILLUSTRATE PROGRESS, POINT TOWARD INTENSIVE DEVELOPMENT

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 3-14

[Article: "On the Path of Effective Development"]

[Text] We have entered 1983--the third year of the 11th Five-Year Plan. The fulfillment of the five-year plan will depend to a decisive degree on the results of the work of the Soviet people this year.

A good deal has been done in past years. The country has reached high goals in economic development, but the tasks which we must look forward to carrying out are even weightier and even more complicated. The unity of the party and the people and the desire to multiply their efforts in order to implement the historic decisions of the 26th Party Congress are a guaranty that these tasks will be carried out successfully.

The solidarity of the party ranks and the people around the CPSU Central Committee was manifested during the days of farewell to Leonid Il'ich Brezhnev. The extraordinary Plenum of the CPSU Central Committee emphasized the continuity of the party's domestic and foreign policy. Yuriy Vladimirovich Andropov was unanimously elected General Secretary of the CPSU Central Committee.

The November (1982) Plenum of the CPSU Central Committee and the 7th Session of the USSR Supreme Soviet of the 10th Convocation considered problems of the development of the country's national economy in connection with the adoption of the plan for the economic and social development of the USSR and the USSR State Budget for 1983. In a long speech at the plenum General Secretary of the CPSU Central Committee, Comrade Yu. V. Andropov gave an in-depth analysis of the condition of the Soviet economy, revealed shortcomings and showed ways and means of surmounting them.

The state plan and the budget for 1983 are based on the party's economic strategy, whose pivotal point is the changeover of the country's national economy to an intensive path of development. At the November Plenum of the CPSU Central Committee the urgency and primary significance of this essential task of socialist management in the modern stage were emphasized with new force.

The decisions of the 26th Party Congress concerning a drastic reorientation of our national economy, relying on intensive methods, have profound scientific substantiation. The fact is that during the past 10 years more than two-thirds of our economic growth has been achieved as a result of bringing additional resources into production, that is, as a result of extensive factors, and only approximately one-third of it involves increasing production efficiency and utilizing resources better, that is, intensive factors.

During 1971-1980 the national income used for consumption and accumulation increased by 55 percent. But in order to provide for such an increase it was necessary to increase the fixed production capital of all branches of the national economy almost 2.2-fold, capital investments--by 66 percent, the extraction of fuel and raw material in industry--by 39 percent, and to increase the number of people employed in material production by 11 percent. As one can see, the intensification took place only as a result of increased labor productivity and a certain amount of economizing on fuel and raw material. But the effect that was achieved here is largely depreciated because of the reduced output-capital ratio and the poor efficiency of the utilization of capital investments. If one attempts to reduce all kinds of resources to a single measure (and this can be done by taking into account the fact that human labor is embodied in each of them), the overall sum of resources, their generalized indicator for the decade increased by 37 percent while the integrated indicator of the efficiency of public production increased by only 13 percent.

In the future the possibilities of our development as a result of enlisting additional resources will decrease sharply because of a number of objective factors. Because of the demographic consequences of the Great Patriotic War the growth of the population of working age will decrease to one-third-one-fourth. Because of this even under the 11th Five-Year Plan the increase in the number of workers in material production will be half as much as under preceding five-year plans. The shortage of labor force must be made up for by an additional increase in labor productivity, and therefore under the 11th Five-Year Plan increased labor productivity should provide for 90 percent of the growth of production, while under the past five-year plan this proportion was only 75 percent. The amounts of capital investments will increase even less. The reduction under the 11th Five-Year Plan is to be 10 percent as compared to the 32 percent growth under the 10th and the 42 percent growth under the 9th Five-Year Plan. This reduction is explained largely by the reduced proportion of the accumulation fund in the national income, which is the main source of capital investments, from 27 percent in 1975 to 25 percent in 1980 and 22 percent according to the plan for 1985. The reduction of the proportion of accumulation is being carried out deliberately in order to obtain additional resources for increasing the public consumption fund. While previously there was a tendency toward decreased effectiveness of capital investments, now it is necessary to improve their utilization. At the same time better utilization of fixed production capital will be increasingly significant. It will continue in the future to increase at less rapid rates.

Radical changes will also take place in the extraction of fuel and raw material. While under the 9th Five-Year Plan the volume of the extracting industry increased by 26 percent, under the 10th it increased by only 10 percent, and under the 11th it is increasing even less. This is related to the less favorable

mining and geological conditions, the shift of the fuel and raw material bases to the northern and eastern regions, and the increased costs of fuel and raw material. Under these conditions our main efforts should be directed toward economizing in all ways on material resources and increasing the output of the final product from each unit of fuel and raw material.

Thus along all these lines it will be necessary to carry out a major restructuring on the intensive path of development and even under the 11th Five-Year Plan to reach a point where no less than half of our economic growth is determined by intensive factors. At the same time it is necessary to prepare conditions whereby, in keeping with the decisions of the 26th CPSU Congress, the economy can be changed over to an intensive path of development under the 12th Five-Year Plan, having provided in the second half of the 1980's for the predominance of intensive methods in the development of the country's national economy.

During the past 10-15 years a good deal has been done to create conditions for changing over to the intensive path of development. Let us note schematically only the main things.

1. Training of personnel for the national economy and the administrative system. The changeover to universal secondary education of youth has been completed. Vocational and technical schools are being transformed into the main school for occupational training of youth. In the system of higher education special attention is being devoted to the development of the abilities of the specialists to see the prospects for the development of the branch and the country's economy as a whole, and to resolve in an intelligent way the tasks of scientific organization of labor and production administration. Regular certification and improvement of the skills of management personnel have been organized. The economic education of all workers is based on a study of the economic policy of the CPSU, Leninist principles and methods of management, economics and organization of production.

2. More extensive participation of workers in production administration. The party Central Committee is emphasizing and disseminating the initiative and advanced practice of a number of labor collectives--the Odessa and Leningrad seaports for increasing labor productivity and accelerating the handling of ships, the brigade headed by N. A. Zlobin for organizing brigade autonomous financing in construction, the Ust-Kamenogorsk lead and zinc complex and the Balkhash mining and metallurgical combine for comprehensive utilization of crude ore, the Orel builders for organizing regular startup of housing and civil construction facilities, enterprises of the Ministry of Chemical and Petroleum Machine Building for changing over to the delivery of equipment in sets, and so forth. New forms of socialist competition are appearing and developing, including competition for accelerated introduction into production of the achievements of science and technology. Control functions have been increased for local party and trade union organizations, labor collectives, people's control agencies, the press and other media over the course and results of economic activity.

3. Improvement of the organizational structure of administration. Provisions have been developed and approved which determine the rights, obligations and responsibility of a number of unionwide ministries and departments. We have

begun to create and develop everywhere production, scientific-production, agro-industrial and other associations. A comprehensive solution to large statewide interbranch and territorial problems, for example, in Western Siberia, has required the creation of unified centralized programs that embrace all stages of the work--from planning to practical implementation, and also the formation of the appropriate administrative agencies.

4. Restructuring of the planning and economic mechanism. It has become necessary to study public needs more precisely, to develop scientific prognoses of our economic capabilities, and to analyze and evaluate comprehensively the various variants of decisions and their immediate and long-term consequences. This has led to a need to expand the horizons of economic planning. It has become increasingly necessary to take a comprehensive approach to planning and to utilize methods of economic and mathematical modeling, system analysis and automated control systems. It has become more important to concentrate efforts and resources on the implementation of the most important statewide programs and to combine skillfully branch and territorial development, long-range and current problems, and balanced growth of the economy. A principle has been formulated whereby administrative and, above all, planning activity is oriented toward final national economic results.

The main directions have been earmarked for strengthening economic factors in influencing production. We have discussed stimulating the development and fulfillment of taut plans, utilizing all kinds of production resources more efficiently, accelerating scientific and technical progress and improving the quality of products. It has become more and more crucial to increase the role of economic agreements and the responsibility for their fulfillment, to develop stable planned assignments and economic normatives, and to increase personal and collective material responsibility of the workers for production efficiency.

5. Acceleration of scientific and technical progress. The changeover of the branches of industry and transportation to the new system of planning, financing and economic stimulation of work on new technical equipment, taking into account the experience of the Ministry of the Electrical Equipment Industry, which was started in 1968, has been continued. The enterprises and organizations have greater mutual economic motivation to transfer scientific and technical achievements and to utilize advanced experience. It has been decided to include in state plans the utilization of major inventions, especially those of an interbranch nature. Scientific centers are playing a greater role in the development of productive forces, including the Siberian Branch of the USSR Academy of Sciences, VUZ science centers, head scientific research institutes and plant research subdivisions.

6. Efficient utilization of natural resources and protection of the environment. Additional measures have been taken for efficient utilization and protection of the natural wealth of Lake Baykal. Similar measures are envisioned with respect to the Volga and Ural river basins, the Black, Azov and Baltic seas, Lake Sevan and others. Assignments have been set for various ministries and departments, and in a number of cases special services have been created and control indicators and deadlines have been established for efficient utilization and protection of the land, forests, living resources in the maritime regions adjacent to the USSR coast, and so forth.

7. Efficient utilization of production resources--land and other natural resources, labor force, fixed and circulating production capital, and monetary funds. Special attention has been devoted, for example, to increasing the efficiency of the utilization of fuel and energy resources in the national economy.

8. Improvement of the production structure. The course toward increasing production efficiency has raised a number of important and complicated tasks related to providing for better proportions among the branches of the national economy. Taking this into account, we have strengthened the foundation of our economy--heavy industry. We have increased the production of equipment for technical support of branches that produce consumer goods and also the sphere of production and nonproduction services. Large quantities of resources have been directed to branches that directly provide for raising the standard of living of the Soviet people. Large changes have also taken place in the distribution of productive forces. In particular territorial production complexes have been formed intensively in various regions of the country, including in Siberia, the Far East, the Ural area, Kazakhstan and Central Asia.

As a result the country's economic potential has grown significantly and our capabilities have expanded. The volume of fixed production capital in the national economy reached 1.3 trillion rubles and the gross social product exceeded 1.1 trillion rubles. The USSR produces one-fifth of the world industrial output. In terms of the extraction of fuel, the production of metal, construction materials and fertilizers, the shipment of timber and milled lumber, the production of many kinds of machine building products, for example, tractors, steam ships, electric engines and machine tools, and in terms of the output of woolen fabrics, leather footwear, sugar and oil, the USSR has risen to first place in the world. The national economy employs more than 125 million people. The country's increased economic strength should now be utilized more fully for solving problems in the remaining years of the 11th Five-Year Plan. And there is a great deal to do.

During the past two years of the five-year plan there has been a certain increase in public production, the material base of the national economy has become stronger, labor productivity has increased and social problems have been solved. Yet the November (1982) Plenum of the CPSU Central Committee drew attention to the fact that, in terms of a number of the most important indicators, the planned assignments for the first two years of the five-year plan were unfulfilled. This pertains especially to indicators of production efficiency: labor productivity is increasing at slow rates, the material-intensiveness of the products is practically not decreasing, and production is being developed at the price of large expenditures and production outlays.

The course of our country's economic development in past years shows the extremely significant influence of the forces of inertia that arise over an extended period of primarily extensive growth of production. As was noted both at the 26th Party Congress and at the November Plenum of the Party Central Committee, it is precisely these forces of inertia that are impeding the change-over of the national economy to the path of intensive development, and it is not easy to overcome them. We need a system of large measures and considerable

efforts on the part of all workers in order to overcome this inertia, the force of habit, and to place the emphasis on efficiency and quality. It will be necessary to break down negative tendencies in the development of the national economy, and during the remaining years of the five-year plan to accelerate economic development, primarily as a result of increasing the efficiency of public production. An important step in this direction is taken in the plan for 1983.

In 1983 the growth of the national income that is used for consumption and accumulation should amount to 15 billion rubles as against 9 billion rubles which is expected in 1982, or by 3.3 percent according to the plan as against 2 percent in 1982. The growth rates of the productivity of public labor should approximately double: the plan envisions increasing it by more than 3 percent. The development of industrial production will be accelerated (a 3.2 percent increase) as will the development of the cargo turnover with all kinds of transportation (a 3.6 percent increase). In keeping with the assignments of the five-year plan, it is planned to increase the extraction of fuel and gas condensate to 619 million tons and the extraction of gas will be increased to 529 billion cubic meters--29.5 billion cubic meters more than in 1982.

A large step will have to be taken in agriculture. During the past few years the volume of agricultural output has stabilized in spite of the considerable strengthening of its material and technical base. To a certain degree this has been related to the difficult weather conditions in many regions of the country. In keeping with the assignments of the USSR Food Program adopted by the May (1982) Plenum of the CPSU Central Committee, in 1983 it is planned to increase the gross agricultural output by 10.5 percent as compared to 1982 and to increase it to 137.3 billion rubles. Meat production for the year will increase by 6.1 percent, animal fat--by 8.4 percent, and cheese--by 6.8 percent. The plan also envisions more rapid growth of the production of consumer goods (group B) in industry than that of products in branches of group A: In group B --3.5 percent and in group A--3.1 percent. In order to provide for this growth it is intended to increase the volume of capital construction by 3.2 percent. About 47 billion rubles will be invested in the development of the agro-industrial complex--4.3 percent more than in 1982.

Accelerated growth of public production, particularly consumer goods, makes it possible to essentially raise the standard of living of the population. The volume of retail commodity turnover is to increase by 5.4 percent, and the volume of sales of consumer services to the population--by 6.8 percent, which is more than in past years. It is intended to exceed the assignments of the five-year plan for 1983 and to put 106.6 million square meters of dwelling space into operation. The real per capita income in 1983, according to the plan, will increase by 3 percent as compared to the average annual increase during the first years of the five-year plan of 1.8 percent. Public consumption funds will increase to an even greater degree--by 4.7 percent. And the average monthly monetary earnings of workers and employees in 1983 will amount to 180.4 rubles, and earnings of kolkhoz workers--130 rubles.

General Secretary of the CPSU Central Committee, Comrade Yu. V. Andropov in his speech at the November Plenum of the CPSU Central Committee devoted his main attention to the creation of economic and organizational conditions which

would make it possible to change the national economy over to the intensive path of development more rapidly and to increase national economic efficiency. The main thing here is to accelerate the work for improving the entire sphere of management of the economy--administration, planning and the economic mechanism.

Our country and other socialist countries have accumulated a significant amount of experience in improving the system of management. This experience shows quite convincingly that the utilization of organizational-economic and social reserves for increasing the efficiency of public production makes it possible to accelerate the growth rates of the national income 1.3-1.6-fold, mainly as a result of additionally increasing labor productivity and improving the utilization of capital, capital investments, raw materials and processed materials. Of course such results are not achieved by the implementation of individual partial measures, but through measures for comprehensive improvement of the entire sphere of economic management.

This was the case, for example, in 1964-1965 when, in keeping with the decisions of the October (1964), the March (1965) and the September (1965) Plenums of the CPSU Central Committee, radical measures were taken to improve planning, administration and the system of economic levers and stimuli in industry and agriculture. This provided under the 8th Five-Year Plan for a considerable acceleration of economic development as a result of additionally increasing the efficiency of public production: according to calculations, the integrated indicator of efficiency increased during the years of the 8th Five-Year Plan by 17 percent as compared to 9 percent during the preceding 5 years.

This experience of our country and the practice of economic reforms in socialist countries have clearly shown that success comes when measures for improving the system of management are envisioned in organic unity with strengthening of centralized management of the economy, which makes it possible to overcome the departmental and local approach, and in combination with expansion of the independence and initiative of labor collectives and a simultaneous increase in their responsibility and concern for nationwide interests. In order to mobilize the reserves of the social activity of the workers, it is especially important to make sure that measures for increasing the standard of living, in turn, influence the increase in the effectiveness and the improvement of the quality of work.

Scientific and technical progress is a main source of intensifying public production. In extensive and rapid introduction into production of the achievements of science, technology and advanced practice lie the main reserves and possibilities of increasing efficiency and improving quality.

It is known that our country has accumulated an immense scientific and technical potential. The large scientific discoveries and technical developments which make it possible to transform entire branches of industry and make them a technological shop of science belong to the nation. Suffice it to recall, for example, the major developments for technical improvement of metallurgy, whose development had seriously lagged behind the demands of the country. Extensive utilization of domestic developments for continuous smelting of steel, nonfurnace metallurgy,

electric slag smelting and other methods of obtaining high-quality metal and methods of thermal tempering would be of decisive significance. For a radical restructuring of machine building on a modern basis, it would be of decisive significance to have mass introduction of methods developed in the country for deformation of metals with the help of a system of specialized presses with super-high pressure which provide for obtaining precision billets (for example, by the method of hydraulic extrusion). Here there is no need to mention the more widespread dissemination of automatic welding installations created in the USSR, the processing centers and flexible automated lines that are controlled with electronic computers, or the introduction of robot technology. Yet many existing technical developments and advanced practice are being introduced poorly. In order to improve the matter it would be expedient to create organizational and economic conditions which would make it advantageous to introduce new technical equipment boldly and, conversely, would place enterprises or organizations that produce outdated technical equipment in a disadvantageous position.

As calculations show, two-thirds of the reserves and capabilities of scientific and technical progress are realized through production machine building or, more precisely, through new technological processes that are based on a modern system of machines and equipment. During the past 10-15 years many branches of production have changed over to the utilization of a new, more efficient generation of technical equipment. Old technologies are being replaced by technological systems of a higher level that provide for a leap forward in labor productivity, in efficient utilization of materials and in improvement of the quality of the products that are produced. We are speaking about extensive dissemination of easily used technologies with a high level of reliability and automation. Electronics has become a real catalyst of scientific and technical progress; methods of chemization and biotechnology are increasingly pervading all branches. And the main thing is that individual partial technologies have begun to be replaced by entire technological systems which embrace the entire process of production from beginning to end, including auxiliary and service work. In many cases it is necessary to overcome branch limitations and regard from unified positions the entire chain of technological ties that provide for transforming raw material into high-quality prepared products that satisfy public demands. The orientation toward final national economic results and toward the social usefulness of the products is now becoming the main concern.

It is precisely from this standpoint that efficient utilization of material resources becomes an extremely large reserve for increasing effectiveness. While in the past in order to increase the output of the final product by 1 percent it was also necessary to increase the supply of fuel and raw material for production by 1 percent, since the material-intensiveness of the products did not decrease, under the 11th Five-Year Plan for every percentage point of increase in fuel and raw material the final output should increase by 2 percent and more. This presupposes quite a different attitude from that of the past toward the utilization of material resources as well as extensive thriftiness and economy. With the increasing expenditures on fuel it is now necessary to spend about half as much in capital and current expenditures to save 1 ton of fuel as it does to extract 1 additional ton of fuel. And the plan for 1983 envisions increased assignments for economizing on fuel, natural gas, petroleum

and petroleum products, thermo-electric energy, metal and other kinds of raw and processed materials. It will be necessary to introduce more extensively energy saving and resource saving technical equipment and technologies, to improve normatives, to put material and moral stimuli to work, and to deal more severely with overexpenditures.

It will be necessary to solve many urgent problems. In his speech at the November Plenum of the CPSU Central Committee, Comrade Yu. V. Andropov emphasized that there are no longer any prepared formulas for solving these problems and it will be necessary to find answers to them by generalizing domestic and world experience and accumulating the knowledge of the best practical workers and scientists. In this connection economic science is faced with immediate and responsible tasks.

Our country has immense capabilities. The party calls upon each of us to contribute as much as possible in his working position for the good of the Soviet people, for the consolidation of peace and for the further flourishing of our beloved homeland.

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RENOVATION, INTENSIFICATION REQUIRE FEWER CAPITALIZED EXPENSES

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 15-24

[Article by R. A. Miyuskiy, candidate of technical sciences, head economist of the Pervouralsk New Pipe Plant, and A. V. Grebenkin, candidate of economic sciences, docent of the Sverdlovsk Institute of the National Economy: "Reconstruction and Intensification"]

[Text] The selection of directions and forms of intensification determines the strategy for the development of enterprises for the long-term period. For the Pervouralsk New Pipe Plant, as for many enterprises of the Ural area, this direction is reconstruction, technical re-equipment of production and modernization of equipment.

This strategy of development has important objective prerequisites. The region has an immense industrial potential. But many plants have long exceeded their planned capacities and have exhausted their internal reserves for current improvement of production. Their production capital is outdated. Therefore, relying on skilled specialists and workers and on a developed network of scientific research and planning and design organization of the industrial Ural area, the enterprises on their initiative in cooperation with scientists and planners are rejuvenating production.

At the Pervouralsk New Pipe Plant the work for reconstruction and technical re-equipment has been in progress throughout practically all the past five-year plans. The plant is becoming one of the largest enterprises of its profile in the country. It specializes in the manufacture of pipes for machine building and installation work. The Pervouralsk workers manufacture, for example, 50 percent of the bearing pipes that are produced in the country, pipes for engines and pipes for parts of machines. A considerable part of the output is used in machine building without any additional processing, and some domestic parts are only ground. With the development of the country's machine building complex the demand for pipes has increased, and with the higher technical level of equipment, the demands on their quality have increased. All this has caused us to engage especially intensively in improving production and rejuvenating it.

Before 1970 the plant introduced mechanization of individual technological operations and also comprehensive mechanization and automation of many pipe rolling installations. Major research work was conducted in cooperation with

the leading institutes of the country--the All-Union Scientific Research Institute of Metallurgical Machine Building, the Moscow Institute of Steel and Alloys, the All-Union Scientific Research Pipe Institute, the Ural Scientific Research Institute of Ferrous Metallurgy and others. The result of this was improvement of the production technology as a result of intensification of the main technological processes--rolling, drawing, chemical processing, heating and so forth. One of the most significant projects was the introduction of "thermal" rolling of pipes. This made it possible to increase the productivity of the cold rolling mills 1.5-fold. The group of plant specialists and scientists were awarded the Lenin Prize for this innovation.

While during this period the main goal of updating production was to increase volumes, in past five-year periods the goals and priorities have changed. It was necessary to increase the output of pipes with qualitatively new consumer qualities. Therefore while under the 8th Five-Year Plan the increase in the production of pipes amounted to 25.5 percent, under the 9th it was 12.7 percent, but the output of high-quality pipes sharply increased.

Under the 10th Five-Year Plan work was continued in the same direction. Twenty-six cold rolling mills were reconstructed at the plant. As a result of this the output of thin-walled carbon pipe made of stainless steel for domestic machine building and electronic industries themselves increased by 16 percent. In order to manufacture pipes out of stainless steel it was first necessary to construct a new shop at an estimated cost of 20 million rubles. Plant specialists in conjunction with Uralgipromez and the technical division of Soyuztrubstal suggested another way. They substantiated the possibility of respecializing two shops for stainless pipes and creating a new industry on the area of one of the shops that was released as a result of reorganization. The most advanced technological processes were applied here: ultrasonic and thermal processing in vacuum contact installations, and so forth.

Expenditures on the creation of this production amounted to 1 million rubles. This is one-twentieth the amount that would be spent on the construction of a new shop. And on an average the expenditures on reconstruction are one-third-one-fourth the amount required for new construction.

The strategy of renovation with minimum capital expenditures places serious requirements on the collectives of enterprises. Much of the work requires initiative and is carried out by the workers and specialists themselves, production is not halted for any length of time and planned assignments are not reduced for the period of reconstruction. The work is financed not from centralized funds, but from the fund for the development of production, allocations for capital repair and also through production costs. It is necessary to make a correct selection of tactical means and methods of conducting the work during each period and for the implementation of each large measure.

The plant has developed its own methods of organization and control of reconstruction. In the first stage--before the development of the plan--a "brain attack" is launched by the collectives of the shop where the work will be done and the plant engineering services. Any suggestions are received, right down to ridiculous ones. Then they are considered with the participation of the

planning-technological and scientific research institutes which will develop the plan. After this the plant submits a technical assignment. The prepared plan is considered by the technical council of the enterprise, but before this head specialists conduct an expert analysis, each regarding his own part. A startup curator group is created for the startup period.

The maximum amount of preliminary preparation which must be done before installing the equipment is determined. The technological line is halted only when everything is ready. Then the halt for reconstruction, as a rule, is combined with the time that is envisioned for capital repair, which cuts off another two weeks. Because of all this, instead of 7-8 months (the average time spent by other plants for similar work), it can be done in 1-2 months.

Let us demonstrate the tactical methods that are used with the example of the reconstruction of the "30-102" hot rolling machine tool in the autumn of 1980. This was the second stage of its reconstruction. The machine tool was put into operation in 1962. It turned out to be very technologically successful, although not all of its design decisions were successful. But one cannot blame the designers. The machine tool is the largest in the country and was created without analogs. The processes of rolling metal were investigated on it and we learned to operate on it.

In the first stage the reduction mill and the furnace were reconstructed. Subsequently they were modernized and changed over to so-called 3-series heating, because of which with an increase in their handling capacity fuel expenditures decreased by 32 percent. The reconstruction of the piercing mill was interesting. The heated pipe billet is "pierced" on it and a thin-walled cylinder is obtained from this. In subsequent milling the cylinder is made into a pipe with the necessary length, thickness of walls and internal diameter. Before 1967-1968 it was thought that the largest angle of incline of a billet fed into a piercing mill was 11-12 degrees and that it could not operate with larger amounts. But the creative brigade of scientists and plant workers decided to increase the angle of incline to 15-17 degrees and, as a result of this, to increase productivity. Now these technical decisions are included in the designs of mills like this. The group of plant engineers, scientists of the Moscow Institute of Steel and Alloys and representatives of the manufacturing plant, Electrostal'mash, were awarded the USSR State Prize for the design of the piercing mill and the new technology. The hot mill has reached its planned capacity of 430,000 tons of pipe a year.

And so the reduction and piercing mills and furnaces were renovated. Further possibilities of the equipment relied on the continuous rolling mill. In the second stage of reconstruction in 1980 it was necessary to expand its production capacities. But the first stage demonstrated something else: there is no point in renovating it in parts. The reconstruction is more effective if it is done according to a comprehensive program and if there is proportional development of all parts of the equipment. Such a program was created and implemented in the autumn of 1980. Now the development of comprehensive programs at the plant has entered into the arsenal of methods of carrying out reconstruction.

Before installing new equipment it was necessary to gather up 2,000 tons of old equipment, to break up 4,000 tons of concrete and to lay 3,000 tons of new concrete in foundations. According to calculations, this work required 2 months, that is, the shop would fail to produce about 100,000 tons of pipes. The builders of the contracting organization suggested that it would be possible to assemble the new equipment beforehand on metal frames and at the same time remove the old equipment and lay the foundation. They suggested block foundations that are manufactured at the plant for reinforced concrete items. They require much less time for construction than solid foundations do.

Having considered all possible ways of economizing on labor expenditures, the plant management included in the schedule instead of 65 days for this stage only 35 days (of which 15 days were for regular capital repair). Actually the work was done in 34 days. On 1 November 1980 the machine tool was put into operation and by 1 January 1981 it had reached its planned capacity--590,000 tons. Such a volume of output has not been achieved with a single other machine tool for hot milling of pipes in world practice. Many solutions were carried out at the level of the latest achievements of science and technology and were protected by authors' certificates of inventions.

Today the capacity of this pipe milling aggregate has exceeded its initial capacity by 250,000 tons and has reached 680,000 tons a year. Good qualitative indicators were achieved, which is shown by the coefficient of expenditure of metal which is low for such aggregates--1.09. It should be noted that in order to produce 250,000 tons of thin-walled small-diameter seamless pipes it would be necessary to construct a special shop which would cost the complex 80-100 million rubles, while all expenditures on reconstruction amounted to 20.53 million rubles, including 7.98 million rubles for construction and installation work. As compared to 1967 when the aggregate's planned capacity was reached, the production cost of products has been reduced by 4.8 million rubles, the expenditure of electric energy--by 28.5 percent, and fuel--by 30 percent. Labor productivity has increased by 74 percent. The commercial pipe from the "30-102" mill has been awarded the state Emblem of Quality.

And still, although under the 10th Five-Year Plan as a result of implementing measures of the comprehensive plan for scientific and technical progress the plan obtained an economic effect of 2.5-3 billion rubles a year, the growth rates of the economic indicators dropped. The output-capital ratio also dropped. Of course this was also affected by the fact that in order to satisfy the need for pipes in automotive construction and power engineering, two new shops were constructed under the 10th Five-Year Plan. The pipes they manufacture are practically prepared parts for machines. But this production involves many cycles and many operations, which led to an increase in the number of workers and a reduction of the growth of labor productivity. The number of workers would have increased even more were it not for the fact that more than 50 percent of the industrial production personnel in the new shops were workers who had been released from the old shops that had undergone reconstruction.

The tendency toward change in economic results can be seen even if one does not consider the new shops (see Tables 1, 2).

Table 1. Change in Structure of Expenditures on Measures for Scientific and Technical Progress Introduced at PNTZ in 1971-1980, %

| Period | Directions of Scientific and Technical Progress | | | |
|-----------|---|---------------------------|----------------------------|---|
| | Automation and Mechanization | Improvement of Technology | Modernization of Equipment | Improvement of Systems of Control, planning and organization of production. |
| 1971-1975 | 19.7 | 60.4 | 7.5 | 12.4 |
| 1976-1980 | 24.3 | 42.8 | 16.1 | 16.8 |

Table 2. Change in Structure of Economic Effect From Measures for Scientific and Technical Progress Introduced at PNTZ in 1971-1980, %

| Period | Directions of Scientific and Technical Progress | | | |
|-----------|---|---------------------------|----------------------------|---|
| | Automation and Mechanization | Improvement of Technology | Modernization of Equipment | Improvement of Systems of Control, planning and organization of production. |
| 1971-1975 | 10.5 | 60.8 | 2.2 | 26.5 |
| 1976-1980 | 7.9 | 51.6 | 7.0 | 33.5 |

In the last stages of reconstruction there was a larger volume of work for mechanization and automation, and the proportion of measures for technical improvement of production decreased. The research stockpile of technology was exhausted. Mechanization in and of itself did not change the technological basis of the production of pipes, which in essence remains multi-operational. Expenditures on mechanization and automation under the 10th Five-Year Plan increased 2.5-fold as compared to the 8th, and the effectiveness per ruble of investments decreased to one-third.

It became obvious that it was necessary to change the strategy of the control of scientific and technical progress at the plant. As a questionnaire showed, the leading plant specialists hold this opinion. The question "Does the existing system of control of scientific and technical progress provide for fulfillment of the tasks?" was answered by 23 head specialists: deputy head engineers, managers of the central plant laboratory and the technical, planning and automation and mechanization divisions, the head mechanic, the head power engineer and the heads of the divisions for scientific organization of labor and administration, and the planning and economics division.

In order to analyze the answers the experts broke them down into 4 groups according to ranks: managers of main technical services (letter--R), specialists of production services (P), specialists of scientific subdivisions of the central plant laboratory (N) and workers in the main technical services (RT).

The work that has been started to form an administrative mechanism for intensive development of the plant includes a number of stages:

Diagnostic investigation of the existing system of control of technical and economic development of the plant, singling out the key problems.

The formation of a system of the goals of intensive technical and economic development of the plant.

The development of special-purpose scientific and technical programs.

The formation of socio-economic criteria of intensive technical and economic development and the refinement of evaluation indicators.

Table 3. Attitude of Head Specialists of PNTZ Toward Existing System of Control of Scientific and Technical Progress

| Variants of Responses | Average | From Groups of Specialists | | | |
|---------------------------------------|---------|----------------------------|------|----|------|
| | | R | P | N | RT |
| Yes, it provides completely for this. | 24 | 20 | 33.4 | 50 | 18.2 |
| It partially provides for this. | 72 | 80 | 66.6 | 50 | 77.8 |
| To an insignificant degree. | -- | -- | ---- | -- | ---- |
| It does not. | 4 | -- | ---- | -- | 4 |

In the first stage there was a questionnaire of plant specialists in which 102 people participated. Expert information was obtained regarding particular shortcomings, tasks and suggestions in the area of technical and economic development of individual shops and industries. Generalization of the particular tasks of the same kind made it possible to formulate shopwide and plantwide problems. With this approach it is possible to provide a high degree of substantiation for the problems that are revealed and for their structure, and it is also possible to adapt subsequent activity, and to coordinate goals and means of scientific and technical development of production with the tasks and shortcomings that have been revealed.

The generalization of the results of the diagnostic investigation showed that plant specialists assigned first place among other problems of the plant's technical and economic development the need for further improvement of technology. Of the 823 suggestions that came in 408 had to do with improving technology, 145--replacing and modernizing technological equipment, and 140--mechanization of labor and automation of production.

The nature of the suggestions and the areas to which they were addressed made it possible to determine the structure of the problems of the plant's technological development whose resolution should be considered both by plant technologists and by workers of branch scientific institutions. Many recommendations were made concerning the technology of manufacturing pipes for the petroleum assortment (drilling), ball bearing, high pressure and all pipes made of alloy steel. Among the most important is the problem of technological lubricants, which should contribute to fuller utilization of the plasticity of the metal, to improvement of the quality of the pipes and to reduction of the coefficient of the expenditure of metal.

Among the more immediate tasks is the application of protective nonoxidizing atmospheres and vacuums. These make it possible to reduce labor-intensive and energy-intensive technological operations and to improve the quality and the operational durability of the pipes.

In almost all of the shops there were proposals regarding improvement of technology and modernization of the sections for finishing the pipes. Finishing operations are still labor-intensive and a good deal of manual labor is used. Losses of metal are great. The recommendations include many suggestions concerning the utilization of modern methods of cutting the pipes (using laser and plasma equipment).

Having analyzed the suggestions and augmented them with recommendations on the basis of a generalization of the practice of research and development in the USSR and abroad, we were able to construct systematized schemata of the directions and variants of improving production technology.

Increasing significance is being attached to problems of technology in the technical policy of the 1980's, which S. A. Kheyman has correctly written about in EKO.* In pipe production the new technological decisions are related primarily to reducing the number of technological operations and providing for a higher level of continuity of individual productions. Flowline technological processes with fewer operations are more convenient and effective for automation of control of production on the basis of electronic computers.

That same reconstruction of the hot rolling mill in the autumn of 1980, during which the number of technological operations was reduced, showed how effective this direction of technical re-equipment is. One of its results was the output of pipe billets with smaller diameters for the plant's drawing shops. In these shops the number of times the pipes passed through the machines during manufacture was reduced and labor-intensiveness was reduced for a number of operations (driving the heads, etching, drawing, thermal processing, trimming, and cutting). The coefficient of the expenditure of metal also decreased. Thus in one of the shops the changeover to billets with a smaller diameter provided for reducing the production cost by 37,900 rubles, including as a result of reducing labor-intensiveness--25,700 rubles and as a result of economizing on metal--12,200 rubles. In another shop when only one operation was eliminated the annual savings for this assortment of pipes amounted to 19,300 rubles.

*EKO, No 5, 1981.

Our plant has constructed a "tree of goals" for intensive technological development with a breakdown of the main problem, and it is developing a complex of scientific and technical programs, the main one of which is the program for technological re-equipment of production. The implementation of this program will serve for subsequently changing production over to the path of intensive development.

It seems that against the background of these tasks the position of scientific research institutes for pipe production is not active enough in searching for areas of technical re-equipment. This work proceeds mainly at the initiative of the enterprises.

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EXPERIENCE OF ONE ENTERPRISE IN CONSERVING RESOURCE INPUTS REVIEWED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 25-34

[Article by I. S. Stepanov, deputy general director of economics of the Elektroagregat Association (Novosibirsk): "Economizing on Resources--An Important Area of Our Work"]

[Text] The Elektroagregat Association is among the material-intensive industries. The proportion of material expenditures in the overall outlays here amounts to an average of more than 60 percent. Therefore economical utilization of material resources plays a large role in the intensification of our production.

Elektroagregat is a supplier of large electrical machines for mining dump trucks with the largest cargo capacities (75 and 100 tons), electrical equipment for diesel-electric tractors with a capacity of 250 horsepower, systems for automated thermal control for turbogenerators and batching equipment for machine tools with numerical program control. Each year we also increase the output of mobile electric power stations and alternating current generators with a capacity of more than 100 kilowatts.

Because of the fact that, in addition to the plants, the association includes the Scientific Research Institute of Electric Drive Units (NIIKE), which is the main developer of our products, we can solve problems of economizing on material resources in all stages of the planning and manufacture of the items.

The work for reducing the material-intensiveness has long been determined in the association by a special-purpose program for economizing on resources and its concrete embodiment in various years--technical plans. These documents envision all the scientific-technical and organizational-economic aspects of the work. The program and the plans contain the following sections:

the development and introduction of new kinds of items with less material-intensiveness;

the introduction of advanced technology, mechanization and automation of production processes;

the application of new, progressive materials;

standardization of components and parts of products that are produced;
improvement of methods of planning and control over the expenditure of materials;
improvement of the organization of material and technical supply;
the creation of a system of incentives for reducing material-intensiveness.

I do not think there is any point in discussing in detail measures of a technical or technological nature. They are related to specific tasks of the association and the specific features of our industry. One might note that we attach a great deal of significance to areas of technical progress that affect savings on resources such as increasing the unit capacities of electrical machines and reducing their sizes, reducing material-intensiveness per unit of capacity, and increasing the productivity of new items as compared to the analogs they are replacing.

Table 1. Dynamics of Technical Specifications of Electrical Equipment for Electric Diesel Tractors and Proportional Expenditure of Metal per Unit of Power.

| Indicator | DET-250 Generator | Electric Engine |
|--|-------------------|-----------------|
| Technical specification, kilowatts | | |
| 1974 | 215 | 166 |
| 1980 | 220 | 196 |
| Proportional expenditure of materials per unit of capacity, kilograms | | |
| Rolled ferrous metals | | |
| 1974 | 5.76 | 8.82 |
| 1980 | 3.31 | 6.31 |
| Sheet steel | | |
| 1974 | 1.19 | 9.53 |
| 1980 | 1.0 | 8.45 |

Thus, when producing 100 sets of numerical program equipment for metal processing machine tools, as a result of utilizing economical profiles of equipment one saves 57 tons of aluminum. Or the creation of a machine tool for automated design of printed circuit cards which, compared to the series produced analog, made it possible to increase productivity 10-fold and to release 9 workers since one machine tool replaces 10 people, and as a result of the reduced need for this equipment, to save 10.5 tons of metal on each machine tool that is produced.

But I should like to discuss in greater detail the organizational and economic measures that contribute to thrifty utilization of material resources. The association's experience shows that the economic services can take on a more

responsible mission in fulfilling the special-purpose program for economizing on resources if they increase the functions of analysis and accounting. True, in order to do this we will have to restructure the service somewhat. Reorganization has affected the association's scientific center to a greater degree. From the planning and economic division of the institute we have singled out the technical and economic subdivision into an independent branch which calculates and analyses the level of expenditures on new developments and conducts methodological work in the area of reducing material-intensiveness.

As far as we know, not only our association but also many others in the stage of scientific research work and experimental design work have not devoted enough attention to calculations of the economic effectiveness of new items and technological processes. In justifying expenditures a major role is played by the planners. Yes, the labor and talent of the developer and his technical ideas largely determine the consumer qualities of a new item. But do they always plan the optimal variants of the utilization of resources, and is the economic effect always guaranteed? It is difficult to give an answer without an in-depth analysis. With the changeover of enterprises of the Ministry of the Electrical Equipment Industry to new methods of control of scientific and technical progress these questions became especially important.

The branch has developed a whole number of standards (OST's), instructions and provisions that contribute to solving these problems, particularly the branch standard concerning the functional-cost analysis (FSA).^{*} Now not a single new item will be accepted by the interdepartmental commission for series production if it has not undergone functional-cost analysis. Nor will it be admitted for certification for the Emblem of Quality without the FSA. Thus in electrical equipment the FSA has officially been proclaimed a method of controlling the reduction of production outlays.

An FSA sector has been created in the technical and economics division of the institute. It coordinates and organizes all work for functional and cost analysis in the association. It includes three groups. The functions are divided among them as follows. The first is responsible for questions of methodology. It engages in the development of standards for the enterprise (STP) from the FSA, methodological instructions and information letters. The second group is responsible for the introduction of the FSA at plants of the association. It relies on the engineering and economics services of the plants. Additionally, the position of engineer-organizer for FSA has been created in each bureau for planning new technical equipment of the plants.

In order to conduct functional-cost analysis for one specific item or another, a temporary working group is created by an order of the general director. In addition to workers of the FSA sector it includes the developers of the item and plant specialists who fulfill the role of organizers and methodologists: economists, technologists, and workers of the material and technical supply division, on whom the work for reducing material-intensiveness largely depends.

^{*}See, for example, EKO, No 6, 1981.

Since ours is the base association in the sub-branch for this problem, the third group engaged in coordinating the work for FSA in the Soyuzelektrotransmash all-union production association. At the Novosibirsk branch of our ministry's Institute For Improving Skills plant specialists also teach FSA methods to workers of their own and two or three other all-union production associations. The association is now completing the task of equipping the methodological center for FSA, which will be able to help with the training at enterprises of the branch and other plants of Novosibirsk and nearby oblasts.

The FSA method has been most developed up to this point under the conditions of existing production. We have created an STP to conduct it for the items that are produced. But it is obvious that the greatest effect from it will come in the stage of NIR and OKR [scientific research work and experimental design work], since the optimal variants revealed in the process of analysis can be taken into account in the new item and it will not be necessary to break down and restructure production. We have now completed the creation of an STP for conducting FSA on new developments.

Like any innovation, the FSA was not introduced without difficulties. It had to overcome a serious barrier of lack of confidence. Attempts to draw attention to optimal variants of expenditures were received unwillingly at first both by production workers and developers, and they were regarded as intervention in the internal affairs of the subdivisions. For from the results of functional-cost analysis there arise, as a rule, proposals to reduce normatives of expenditures, to replace and justify costly parts with more economical ones, and so forth. That is, these suggestions involve restructuring, additional troubles, and a reduction of the limits on materials.

Perhaps because the first steps of the FSA specialists were far from clear, they defended their positions with an innovative arrangement of the matter and not only conducted economic diagnosis, but also looked for ways of implementing their suggestions themselves. Here are several episodes from their activity.

The association is constantly experiencing a shortage of stainless steel for producing coffee pots which in the plan are not the main product, but goods for cultural and domestic purposes. When conducting the FSA for the item the specialists of the sector devoted attention to the fact that instead of using an entire sheet for manufacturing the top and bottom of the coffee pot it is possible to use stainless steel scrap from the Riga Electrical Machine Construction Plant in our branch. Even after expenditures on transportation the cost of the parts would be reduced by half, not to mention the savings on this metal that is in short supply.

Our production workers, if they did not resist the suggestion, in any case were unenthusiastic about it. Specialists in FSA themselves went to the sanitary and epidemiological station in order to check the Riga wastes for the possibility of utilizing them for this new functional purpose, they themselves obtained permission from the sub-branch to obtain the wastes, and they themselves handled the negotiations concerning transportation.

In another instance the FSA sector drew the attention of developers to the utilization of parts made of metal powders. To do this they had to be concerned about concluding agreements for the manufacture of 100 of these parts at a

related plant of the sub-branch and also about testing them. But now powder metallurgy has been included in the plan for the association's new technical equipment.

This instance convinced many of the usefulness of the FSA. Workers of the sector analysed the sales of waste nonferrous metals of Sibelketrotransmash and demonstrated that their cost had decreased. The economic calculation that was done made it possible to increase the sum obtained for the sale of wastes. Thus the barrier of the lack of confidence was gradually overcome, and the FSA method has become an important instrument in reducing expenditures.

Among the other important functions of specialists of the technical and economics division one should take note of their participation in the creation and introduction of standards and methodological suggestions that regulate the requirements for reducing material-intensiveness in new developments. These requirements are registered in the STP's "Evaluation of the Technical Level and Quality of Items," "Standardization of Items, Assembly Units and Parts," and "Methods of Calculating the Reliability of Machines."

When evaluating the technical level and quality one does the calculation of the planned indicators of the item being developed which includes indicators of material expenditures as well: material-intensiveness per unit of capacity and the coefficient of the utilization of metal on an average for the item and for individual groups of materials (transformer steel, rolled ferrous and nonferrous metals). The technological and economics division does not approve an item for production if in its development the material-intensiveness turns out to be higher than the item it is replacing and there has been no technical justification for increasing it.

In the stage of production the improvement of the system of planning and control of the utilization of resources proceeds through the application of normative methods of calculating production costs and accounting for expenditures.

As we know, the normative method envisions preliminary calculation of the production cost of products based on existing progressive norms for the expenditure of materials, batching items and wages, and also the disclosure of deviations from the normatives in the process of manufacturing the products. It makes it possible to prevent inefficient utilization of materials and fight against intraproduction losses as well as to control internal reserves.

One must say that the normative method of accounting for expenditures was being applied at the head plant--Elektroagregat--even before the creation of the association. In Sibelektrotransmash as in many other enterprises with small series production there was a method of accounting for expenditures on the basis of actual outlays on production. But the normative method existing at Elektroagregat did not fully correspond to those requirements that were placed on it. In particular there was no policy for formulating temporary deviations from technical specifications in the process of production. Consequently there could be no efficient daily control over material and labor expenditures. Therefore specialists of the association resolved two problems at the same time: the development of normative methods of planning and accounting for expenditures on production based on a unified methodology and the application

of these methods in all subdivisions (shops). The work is not simple and it is extremely labor-intensive. Suffice it to say that the association has been assigned more than 600 products (taking into account various types of manufacture) and 885,000 time norms have been registered in the shops.

The development of normative calculations for parts, components and items and prompt changes in them are the responsibility of the bureau of normative management that has been created as part of the planning and economics division. But participating in the preliminary preparation are the divisions of the head designer, the division of the head technologist and the division of labor and wages, who have submitted the initial documentation--information, norms for the expenditure of material and batching items, labor expenditures and so forth.

Which documents regulate our new methods of accounting? Above all the instructions concerning the normative method of accounting and the STP concerning the policy for formulating temporary deviations. The accounting is organized on the basis of charts of normative expenditures per part, component and item. The chart, which is developed in the association, consists of two parts (blank forms). The first reflect all the operations performed on the part, norms of time and price rates, and the route along which the part moves; the second includes material expenditures (names of materials, brands, sizes, expenditure norms, prices and so forth).

At the same time the release of materials and batching items from the warehouses and storehouses is also regulated. This is done according to limit charts and the requirements of a single model. If for some reason there is a need to obtain resources in excess of the planned normatives, the request is underlined in red and the bookkeeping offices register these expenditures as deviations from the norms. The planning and economics division keeps operational accounts of deviations from the norms which are the result of the replacement of materials and batching items.

The system of control over wastes of materials is also an important aspect of the organization of normative methods of accounting. This control is exercised in the association in the following way. On the basis of the normative for expenditures one calculates the possible wastes of materials. The comparison of the actual wastes with the calculated amounts gives information about the positive and negative results. Under special bills of lading the wastes are either sent to the storehouse (if they cannot be used in production) or to the section for collecting waste metal. On the basis of these bills of lading one writes off or reduces expenditures on the production under the item "material-intensiveness."

The production of consumer goods is centralized at the head plant of the association. Because of this there has been a sharp improvement in the utilization of stainless steel scrap from which we manufacture lids for canned goods which are in short supply. The utilization of wastes of transformer steel for producing the cores of transformers for small electric machines is centralized at the Sibelektrotransmash plant.

Regulation of deviations is very important with the normative method of accounting. But the enterprises, unfortunately, do not yet have conditions whereby they can use only the best materials, economical profiles of rolled metal and so forth. Difficulties in supply make it necessary to constantly maneuver in order to replace one thing with another. Moreover, when assimilating a new item design and technological shortcomings can be revealed in production which were not apparent during the manufacture of the experimental model. One cannot but take this into account, but it is also impossible to let things proceed of their own accord, for then losses are inevitable. Therefore, we have also created a special standard for the enterprise concerning temporary deviations, we have classified possible kinds of them, and we have determined the policy for obtaining permission for deviations. The permission is documented on a standard form. And only this can grant the right to deviate from technical specifications if the replacement of a material or batching item does not affect the reliability, if the technical and operational specifications of the item are not changed, and if its quality is not reduced.

In order to put an end to work with verbal instructions and memorandums, the STP includes a point to the effect that only those jobs that are performed with "permissions" are credited to the fulfillment of the plan and the rest are not, and sanctions are applied to managers of services who refuse to fill out the permission forms.

With all the merits of the normative method of accounting one cannot forget about the fact that it is labor-intensive and requires constant and painstaking work and a good deal of manual labor. And this alienates many people. Computer equipment helps to eliminate labor-intensive routine operations and improve the methods. Using electronic computers, we have preliminarily studied the experience of the Volga Automotive Plant, which is more progressive but not entirely suitable for us since the Volga Automotive Plant has mass flowline production, and we have also studied the practice of the Novocherkassy electric locomotive construction plant. Then we began to develop a complex of tasks for introducing normative methods of accounting into our automated system for control of production. The following main tasks have been planned for the association's automated control system:

calculation of the normative production cost in terms of direct expenditures on planned and actual commodity output;

calculation of normative production cost of incomplete production;

accounting for expenditures on the creation of new technical equipment that are financed from the unified fund for development of science and technology;

analysis and evaluation of losses from defective products;

tasks included as part of the normative base.

In the work for reducing material-intensiveness a large role is played by motivation to economize on resources. Taking this into account, we have revised the provisions that were in effect in the association concerning bonuses. Incentives for management personnel and engineering and technical

personnel to achieve good basic results of production and economic activity have been made directly dependent on the fulfillment of assignments for reducing norms for the expenditure of all kinds of material resources. If this indicator is not fulfilled the amount of the bonus is reduced by from 15 to 50 percent, and if the indicator is overfulfilled the bonus is increased.

The next important source of providing incentives for economizing on resources is the economic incentive fund for the creation, assimilation and introduction of new technical equipment which is in effect at enterprises of the Ministry of the Electrical Equipment Industry.

Bonuses from this fund are paid to workers and engineering and technical personnel who have participated directly in reducing the material-intensiveness of products and economizing on material resources.

In past years the association has attached a great deal of significance to provisions concerning bonuses for workers, brigade leaders and masters for overfulfillment of assignments concerning economizing on nonferrous metals. But we did not invent the bicycle: the standard provisions have been in existence for a long time (since 1972). But they were not "working" for us. And only when we concretely coordinated them with the individual accounts for economizing did they acquire meaning. The role of socialist competition in terms of individual accounts for economizing also increased, especially in billet shops, that is, where one can clearly calculate the real amount of metal that is saved.

The entire complex of measures of a technical and organizational nature made it possible to achieve certain results. During the years of the 10th Five-Year Plan we succeeded in saving about 2,500 tons of ferrous metals and about 300 tons of nonferrous metals. Material expenditures per 1 ruble of commercial output decreased by 14.2 percent during the five-year plan. The special-purpose program for the 11th Five-Year Plan envisions reducing material expenditures by 19.5 percent as compared to the planned amount. Almost all of the increase in the volume of products will be achieved without increasing funds for materials. This will also entail economizing on resources.

Were it not for difficulties in material and technical supply one could have counted on even greater results from economizing. It is known that it is frequently necessary to replace one brand of metal or profile of rolled metal with another which is less economical and more expensive simply because the necessary ones are not available and there is a danger of halting production.

One should also mention that if the enterprise had the right to dispose of the saved resources independently it could have achieved a greater effect. Let us assume that our association has formed certain surpluses of transformer steel as a result of efficient expenditure of it. Our neighbor is in the opposite situation but he has stainless sheet metal, without which in this 10-day period we are under the threat of halting the production of goods for cultural and domestic purposes. But we are not allowed to exchange with one another. It would clearly make sense to give the managers of enterprises greater rights in the area of maneuvering resources that have been saved.

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SHORTFALLS IN ONE METALLURGICAL SECTOR HAVE NEGATIVE REPERCUSSIONS IN OTHERS

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[Article by S. A. Golobokov, candidate of economic sciences, docent, Zhdanov Metallurgical Institute: "Supplier--Road--Consumer: All Have Different Interests"]

[Text] Even the unsophisticated reader knows that the work of one metallurgical enterprise affects thousands of other enterprises that are consumers of the metal. At the same time approximately 90-95 percent of the cost and volume of materials consumed by the metallurgical enterprise are products from other enterprises--sintercake, coke, limestone, ore, scrap metal and so forth. For example, the average metallurgical plant consumes 1,500 tons of sintercake per hour, coke--350 tons, and so forth. Such intensiveness of consumption of the main materials should be accompanied by efficient organization of their dispatch and delivery. But in reality the picture is somewhat different.

The first thing one sees is the lack of regularity in the delivery of the initial materials. The irregularity of the delivery of railroad cars amounts to approximately 300 percent. This means that if the average interval between two related deliveries is 5 hours, in certain cases it can increase to 20 hours.

The lack of regularity in deliveries of materials is reflected in the work of all metallurgical aggregates, but the greatest blow is experienced by shops that are the direct consumers of the raw material that is delivered: sinter, blast furnace, marten furnace, and in cases where the enterprise purchases ingots and slabs, the milling shops as well. A failure to deliver any material to the blast furnace shop leads to incomplete supplies, a violation of the planned material balance, a restructuring of the technology for smelting iron and, finally, the output of iron of a different brand and class. There are 1,000-1,200 cases of such restructuring each year. As a rule, each of them involves harm to production. The losses of just one enterprise and from just one blast furnace amount to 3-4 million rubles a year.

For a metallurgical plant any irregularity in arrivals--both shortages and surpluses--has negative consequences. And not only because this always leads to incomplete assortments of materials. When there is an excess, for example, of sinter it is necessary to unload it in the ore yard, which causes it to

crumble and lose its technological properties, the small particles have to be removed, then it is necessary to cake it again, and so forth.

In order to disclose the reasons for irregular supply, let us analyze the entire path of movement of the materials.

For metallurgical plants the materials of intensive consumption are produced mainly within the framework of ferrous metallurgy--at mining enterprises, enriching factories and scrap metal shops, and the majority of them (sinter, coke, limestone and so forth) are the only product of these enterprises. This circumstance is an extremely favorable condition for synchronizing their production and consumption. Long-term economic ties and the route method of delivering materials could also contribute to stabilization of deliveries. These possibilities are not being properly utilized. Why?

Primarily because the mining industry is lagging significantly behind metallurgical production and the plants most frequently operate with a critical shortage of raw material. The supply of it in the sinter factories of the enterprise is adequate at best for 2-3 days of operation with a normative minimum of 10 days. The supplies are frequently incomplete in terms of assortment and this precludes spreading them out and providing the proper amounts when they are being prepared for sintering. Ore enriching enterprises of the Krivoy Rog basin in recent years have failed to deliver their consumers hundreds of thousands of tons of sinter, pellets, concentrate and ore. It is becoming increasingly difficult to coordinate the production plan with the plan for supply under these conditions and there are more and more complaints against planning agencies that are responsible for coordinating these plans. It is perhaps now the case that the production plan does not regulate the availability of materials at the enterprise but, conversely, the availability of the initial product determines the output of the final one. This also partially explains why the metallurgical enterprise does not always fulfill the plan in terms of orders, products lists and volume.

In order to eliminate the shortage of materials it is necessary not only to balance the production of metal with the production of raw material, but also to create a nominal supply of the latter. Without this stable operation of the enterprise and production or economic maneuvering are simply impossible.

Of the aforementioned 300 percent irregularity, only 10 percent comes from the production of materials. The remainder is the result of tardy release of railroad cars. Many specialists think that it is possible to eliminate the influence of this factor on the process of supply by creating a reserve fleet of railroad cars. Calculations show that then the idle time of railroad cars would be even less than those caused by irregular delivery of materials to the consumer. Now, when everyone is talking about the need to reduce idle time of railroad cars and to accelerate their turnover and they are even suggesting introducing a card file system for their distribution, the creation of a reserve stock for delivery can seem untimely. But with the present conditions we simply see no other way.

Under these conditions the supplier lives like some kind of self-willed child who can transfer the rolling stock with the raw material to the nearest railway station at any hour of the day or any day of the month. And neither the existing norms that regulate the interrelations between supplier and consumer nor the schedule for dispatch that is coordinated with the consumer which indicates only the daily volume can prevent this, and not a word has been said about the time at which one delivery or another should be dispatched. Incidentally, if in preceding days the delivery was dispatched at the beginning of the day and in the next days, at the end (and this happens everywhere), when there is daily consumption of material which is equal to the volume of deliveries, the sets of equipment can remain without raw material for days. Nonetheless the daily plan for dispatch is fulfilled and there is no justification for punishing the supplier. The existing organization of supply has transformed violations of technology into the norm and there are no guilty parties.

In spite of the great intensiveness of the consumption of materials and the strong technological link between their production, delivery and consumption, the margin of error is still days and not an hour. This margin does not contribute to speedy processes in metallurgy and therefore the object of control--the specific delivery--is not subject to regulation. Under these conditions no electronic computers will help at all.

With the rates of consumption that are typical of today it is necessary to plan the volume of shipment for days, and the volume in time of shipment of each delivery during the course of the day, and a determining aspect of the new organization of deliveries should be the rate of production by the consumer--the final result of the activity of the supplier and the transportation organization. Only then will the possibility of synchronizing the production and consumption of materials become a reality.

A question can arise: Why not eliminate this freedom in shipment that is so burdensome to the national economy in a simple way--strengthen contractual discipline by simultaneously solving the problem of synchronization and orientation of the system toward final results?

Such a solution to the problem will produce little unless it is coordinated with other problems. An hourly schedule cannot become an element of a kind of organization that allows shortages of raw material or late provision of railroad cars. There must be related changes in all factors that regulate the distribution of materials from the supplier to the consumer. And when one tries to introduce hourly schedules (there are cases of this) without being concerned about related problems, the time during which they are in effect turns out to be insignificant. In order for an hourly schedule not to appear to be an alien element in the organization of supply, it is necessary to revise many provisions that regulate the relations between the supplier and the consumer, including the structure of evaluation indicators for the suppliers. It must become a rule for the plan to be regarded as fulfilled when the supplier has sent the material to the consumer in keeping with the schedule.

Other obstacles that impede synchronous delivery of materials are discovered as soon as the rolling stock comes under the jurisdiction of the Ministry of Railways--at the switchyard. According to the existing rule the route is

decided not at the time the rolling stock arrives at the station, but within 24 hours of that day on which it was transferred to the Ministry of Railways. This provision is included in the rules for railroads and for shipping cargo, and it reserves time for technical operations related to inspecting the rolling stock. There is no doubt that it is necessary to plan time for this, but how does one justify the need to register the receipt of the cargo at the end of the day? After all, if the cargo is delivered at the beginning of the day a considerable part of it can remain there for no reason. The delivery of cargo by the suppliers at the end of the day, of course, averages out the picture, but the main thing is that in any case this is another source of irregularity in the overall chain of delivery of materials to the consumer. Railroad workers themselves do not conceal the fact that the reason for the large difference between the average speed of delivery (11-15 kilometers per hour) and the average technical speed of movement of cargo trains (45-50 kilometers per hour) lies mainly in the prolonged initial and final operations. The press has repeatedly raised the question of revising norms that regulate the shipping process, but nothing has been done. Is there any point in regulating the time of dispatch of each delivery if in the next stages the result of the regulation will be reduced to zero?

But then the rolling stock has moved and made its way to the consumer. The average speed of delivery of cargos by rail is only twice the speed of animal drawn transportation and in cases where the cargo has to be transshipped from one kind of transportation to another they are even the same. Of course mass materials are delivered more rapidly, but here too there are some "buts." Thus raw material from the Krivoy Rog basin to Zhdanov (approximately 500 kilometers) can be delivered from within 15 hours to within 2 days. According to the existing norms it takes several days to cover this distance. Why such a difference? There are various reasons, but the main one is the lack of a commitment on the part of the railroad to deliver the cargo to the consumer promptly. When the operation of the metallurgical aggregates is stopped, the dispatchers of the consumer enterprises literally "drag" the cars out of each station. Success is brought about not by economic stimuli (the Ministry of Railways has no motivation to accelerate deliveries), but by many years of business contacts.

If deliveries are not made on time the Ministry of Railways is fined, but the sum of the fine does little to cover those losses that are borne by the consumer. In order to eliminate all losses it is necessary to have a qualitatively new level of deliveries which is based on guaranteed delivery of materials.

In an article by the chief of the transportation division of the USSR Gosplan, D. Zotov, which contains a just criticism against the Ministry of Railways, he supports the suggestion to introduce a normative for time periods for the delivery of cargos.* But, in the first place, such a normative already exists, although it is probably not very differentiated. In the second place (and this is the main thing) the fact that it exists in no way changes the situation: the length of time for delivery along the routes essentially differs from the normative. And this is not influenced even by the fact that the route shipments, in terms of the priority of the time periods for delivery, come right after passenger transportation.

*PRAVDA, 16 September 1980.

If one proceeds from the final result, it is important to observe not the length of time for delivery (this is the intermediate result), but the fact that each individual shipment should be at the unloading point at the time that was planned or agreed upon--a certain hour of the day. And if the interests of the consumer require changes in the speed of delivery and cause additional expenditures for the Ministry of Railways, of course one cannot forget about the economic interests of the railway workers either.

It is thought that there is another way of stabilizing production: the creation of stockpiles by the consumer himself. In this case the stockpile is supposed to compensate for the poor organization of supply, but, as calculations show, the amount has to be so significant that it makes the very idea of stabilizing production pointless. And not only because an immense mass of materials is withdrawn from circulation, but also because there is not enough room to store them.

The only way of improving deliveries is to intensively increase the regularity in the work of the transportation system. Capital expenditures are necessary for this.

It might seem that the utilization of an hourly schedule makes the working conditions of the parties joined together by economic bonds excessively rigid. But this is not the case since they will only use schedules that are coordinated in the stage of planning with all of the participants. Moreover, an hourly schedule in principle allows any behavior on the part of the supplier or the road with respect to the consumer, but requires that deviations be compensated for by corresponding reserves and do not affect the regularity of the work of the consumer. This also envisions stockpiles for the consumer which compensate for various deviations which are impossible to foresee, but they are insignificant as compared to other variants of the organization of supply. A reorientation of the economic mechanism toward final results inevitably leads to centralization of supplies and, consequently, to a reduction of their overall volume and the elimination of the situation which exists in the country as a whole whereby 80 percent of the total supplies are with the consumer.

The measures that have been proposed are not enough to decisively improve the existing policy for deliveries. But they predetermine the general direction for the development of the economic mechanism. Whether they are orphans in a home that is not ready to receive them or the system assimilates them in a limited way depends entirely on the fundamentals of organization, the makeup of indicators that regulate the activity of the enterprises and on the goals of stimulation.

The existing indicators establish goals not in terms of the use to which the cargo will be put, but in terms of individual stages of its movement that correspond to spheres of influence of various branches. For the branch they are final, but for all the rest of the system of production they are intermediate. And this is why they are not at all affected by the stimulating influence of the final result: it is important for the supplier to make the delivery in the necessary volume, but not to deliver it at the specified time. The trains are going faster and faster on the railroad, the turnover of cars is accelerating,

the plan in ton-kilometers is being fulfilled and overfulfilled, but there is no guaranty that the material will be delivered at the necessary time. The weakening of economic ties in a system that is continuously becoming more complicated is costing more and more: stockpiles are growing, the supply for enterprises is increasingly becoming a weak point, it is more difficult to achieve regularity in labor and production, and so forth. The affect obtained within the branch can be accompanied by considerably large losses from organizational lack of coordination at the juncture of the branches, but, as a rule, attention is not devoted to this. Inter-branch barriers that are propped up by one indicator or another impede the introduction of innovations that are directed toward merging the interests of the interacting parties.

The press has repeatedly discussed the need to improve evaluation indicators. Unfortunately these articles have not produced the proper effect yet. The main indicators of the Ministry of Railways and the enterprises are tons-kilometers and volumes of production in tons and rubles, that is, indicators that involve only these enterprises themselves. The indicator of normative net output which was introduced under the 11th Five-Year Plan can only provide so much--correct calculation of labor productivity, stimulation of a reduction of material-intensiveness and so forth. Strengthening of economic ties is not its prerogative.

The slow renovation of organizational fundamentals of administration of the enterprise provides rich soil for the development of false methods of solving problems. Certain managers still place great hopes in the utilization of electronic computers for strengthening economic ties. This is partially explained by the considerable number of technical specialists who are engaged in economic and administrative problems. These ideas are also quite common among specialists of information and computer centers in nonferrous metallurgy. But the solution to organizational and economic problems cannot be reached by technical and economic-mathematical methods alone.

The disproportional development of production contributes to reducing the stability of the operation of metallurgical plants and increasing the number of intraplant shipments. The construction of a shop at the enterprise is most frequently brought about by disproportionations in the material balance of the branch and not in the balance of the enterprise itself. The 3600 machine tool which was rapidly built in the middle of the 1970's at the Azovstal' plant required gathering ingots bit by bit from all enterprises of the country, right down to the Urals and Western Siberia--because the plant itself had no reserves. Now the situation is exactly the opposite. After the startup of the oxygen converter shop there was a surplus of steel. More than 100 million tons of billets a year are now shipped to Cherepovets, and some of the products obtained from them there are shipped back to the Ukraine.

Other plants are in the same situation. One plant is constructing a steel complex while another one is constructing a milling complex, and shipments are necessary in order to join them together. As a result, millions of tons of ingots travel along the roads of the country. The existing system of indicators only encourages this method of development of production because interplant shipments constitute an essential addition to the volume of "sales." It is

possible that precisely this fact has been a determining one in the existing organization of the supply of enterprises with scrap metal, where almost each one sends to others as much as it receives.

Stable supply of metallurgical enterprises cannot be ensured within the branch since it involves too broad a spectrum of problems. Local improvements which are not coordinated with the total picture of changes taking place in the national economy are no substitute either. On the contrary, only solutions to the major problems open up the path to effective solutions to particular problems. Reorientation of the national economy toward the intensive path of development and toward the achievement of final results, good quality and efficiency--these are the main problems.

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ISSUE OF COMBINING OIL, GAS INDUSTRIES ADDRESSED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 44-51

[Article by L. N. Shadrin, candidate of technical sciences, All-Union Scientific Research Institute of Organization, Administration and Economics of the Petroleum and Gas Industry (Moscow): "The Petroleum and Gas Industry: Is It Not Time to Combine Them?"]

[Text] The majority (about 90 percent) of the volume of primary fuel and energy resources that are used are petroleum, gas and coal. And more than two-thirds of the fuel balance is provided by petroleum, gas condensate and natural and casinghead gas.

Noting the successes of the petroleum and gas workers during the past five years and taking into account the importance of the tasks facing them under the current five-year plan and until the end of the 1980's, it is appropriate to raise the question: how should petroleum and gas extraction complexes develop in the future--within the framework of individual branches as is now the case or in a unified unionwide ministry of the petroleum and gas industry?

Closely Related Branches

The specialization of the gas industry that was undertaken in the middle of the 1950's played an important role in its development. In terms of the growth rates of the basic volume indicators not a single other branch of the national economy can be compared with it. In 1956 when the gas industry began to function as an independent branch, all of its production units produced 12 billion cubic meters of gas. In 1980 the country received more than 435 billion cubic meters of natural and petroleum gas. The average annual increase in extraction during all this time of the branch's operation amounted to more than 17.6 billion cubic meters.

With the rapid expansion of the geography of the distribution and the growth of the production capacities of the gas industry, one cannot but note the circumstance that it has developed side by side with production and nonproduction facilities of the petroleum industry which once gave birth to it. Both of these branches are fully responsible for organizing work to create

supplies and extract "their own" minerals, to drill extraction and prospecting wells, to put new petroleum and gas extraction capacities into operation promptly, to actively introduce the achievements of scientific and technical progress into practice, to improve quality, and to prepare, transport and partially process hydrocarbon raw material. In addition to these completely duplicated kinds of activity, the Ministry of the Gas Industry constructs and operates underground gas storage facilities, provides gas for population points of the country, and produces individual kinds of gas equipment (stoves, gas heaters, liquid gas cylinders and so forth).

In certain kinds of activity these branches augment one another. In 1979 585.6 million tons of petroleum (with gas condensate) were extracted. Of this amount 21.7 million tons (about 3.7 percent) were from extracting enterprises of the gas industry. This mass of incidentally extracted fuel is approximately equal to the annual volumes of the joint activity of ten of the 28 specialized territorial production associations of the Ministry of the Petroleum Industry which have been in operation or to the sum of the annual results of the activity of the Krasnodarneftegaz, Dagneft', Azneft', Grozneft' and Belarus'neft' associations.

On the other hand, of the 406.6 billion cubic meters of natural and petroleum gas extracted from the earth in 1979, 51.2 billion cubic meters (12.6 percent) were extracted by petroleum workers in the form of natural (5.7 percent) and casinghead (6.9 percent) gas. According to the results of 1979, this indicator of the petroleum workers greatly exceeds the total extraction from ten of the 15 territorial gas extraction associations of the Ministry of the Gas Industry, or is equal to the annual results of the activity of such production associations as Orenburggazprom and Noril'skgazprom taken together. In 1979 enterprises of the Ministry of the Gas Industry extracted and salvaged 3.6 billion cubic meters of casinghead gas.

The sphere of processing petroleum (casinghead) gas, natural gas and gas condensate provides another example in which the activity of the petroleum and gas industry coincides. At the beginning of 1980 there were six gas processing plants in operation in the Ministry of the Gas Industry, nine of these plants in the Ministry of the Petroleum Industry and three production associations, including Ukrneftegazpererabotka (including five gas processing plants), Sevkavneftegazpererabotka (two gas processing plants) and Sibneftegazpererabotka (five gas processing plants). Of course the basic raw material of plants of the Ministry of the Gas Industry is natural gas, while at the gas processing plants of the petroleum industry they process mainly casinghead (petroleum) gas. The proportion of natural gas used as raw material at plants of the Ministry of the Petroleum Industry is relatively small. But the structures of the industrial output produced by the gas processing plants of the Ministry of the Petroleum Industry and the Ministry of the Gas Industry are similar in terms of a number of basic positions.

The utilization of casinghead petroleum gas as raw material for gas processing plants and inexpensive fuel for thermal electric power stations does not fully remove the problem of efficient utilization of these resources. Although in recent years the percentage of utilization of the volumes of

petroleum gas has regularly increased, this indicator for the country as a whole is still low. In 1979, for example, it was 71 percent. This means that during the course of this year alone part of this most valuable and irreplaceable hydrocarbon raw material was burned in flames. It is necessary to take additional measures and establish a limit which cannot be exceeded when burning casinghead petroleum gas in flames or dispersing it into the atmosphere.

In the majority of cases the territorial production petroleum and gas extracting complexes develop side by side, on the basis of a unified regional system of petroleum, gas, petroleum-gas and gas condensate deposits. In addition to the extremely obvious example of the assimilation of the Western Siberian petroleum and gas basin, where deposits are located next to one another and consequently there are also production and other industrial and nonindustrial, housing-domestic and social-cultural facilities of the Ministry of the Petroleum Industry and the Ministry of the Gas Industry, there is a similar situation in at least ten other administrative regions of the Soviet Union. In 1979 petroleum and gas extraction complexes that were located next to one another produced 65.3 percent of the petroleum (including gas condensate) and 94.3 percent of the gas (including petroleum gas) in the unionwide volumes of extraction.

As for the associations that have no neighbors and are among the related branches of the processing industry, of the 16 that fall into this category of petroleum regions, ten of them extract natural gas in addition to petroleum (and gas condensate) and 14 of them extract casinghead petroleum gas. Three (of the four) production associations of the Ministry of the Gas Industry that are included in this group extract significant volumes of petroleum in addition to gas.

Having no suspicion of the departmental separation of the petroleum and gas extraction enterprises, in many cases nature has created serious problems by gathering together all kinds of hydrocarbons in a single deposit. In the productive layer of the Urengoy deposit, for example, in addition to large supplies of gas there are also certain resources of gas condensate and petroleum. In order to utilize them with maximum efficiency it is necessary to have comprehensive processing of gas, condensate and petroleum. But this is possible only if there is only one master in Urengoy, one who is equally responsible for the extraction of all three kinds of natural hydrocarbons.

The practice of extracting immense volumes of casinghead hydrocarbons--the main product of the related branches of the industry--has also determined the structure of the supplies of productive wells. At the beginning of 1980 gas workers were operating several hundred oil wells and petroleum workers--1,416 gas wells. Operational drilling for gas in gas extraction regions is done by drilling enterprises of the Ministry of the Gas Industry and the Ministry of the Petroleum Industry. In 1979 the ratio of the volumes of drilling of wells for these purposes among the aforementioned branches was 5:1. Along with enterprises of the gas industry in 1979 the drilling of gas wells was done by nine territorial production associations of the petroleum industry.

Exploratory drilling for gas in gas extraction regions is carried out through the efforts of the USSR Ministry of Geology, the USSR Ministry of the Gas Industry and the USSR Ministry of the Petroleum Industry. In 1979 the ratio of the volumes of exploration drilling of wells among the aforementioned branches was 8.4:3:1. Deep exploratory drilling for gas was carried out by 14 large territorial structural units of the USSR Ministry of Geology (including three of the Ministry of the Geology and one administration of geology of the union republics, Glavtyumen'geologiya and nine territorial geological administrations), 11 production associations of the Ministry of the Gas Industry and nine production associations of the Ministry of the Petroleum Industry.

Whatever has been said certainly does not mean that there are close business relations among drilling enterprises of related branches that are located in the same geographical and administrative region. For example, the drillers of Glavtyumen'neftegaz and Tyumen'gazprom, as a rule, work as if they were separated by a thick wall and know little or almost nothing about the technical and economic achievements of the other. The experience that has been accumulated by petroleum workers in organizing high-speed drilling of petroleum deposits in Western Siberia is not being used by the drilling and subcontracting enterprises of Tyumen'gazprom. From the results of 1979 it was established that Tyumen'gazprom is behind Glavtyumen'neftegaz in terms of the mechanical speed of drilling--by 40.7 percent; in terms of the commercial speed of drilling--by 44 percent; in terms of the average annual progress of one drilling brigade--by 60.9 percent; and in terms of the average annual progress for one working machine tool in drilling--43.3 percent.

The drillers of Tyumen'gazprom have spent almost 79 percent more time for every 1,000 meters of driving than their colleagues from Glavtyumen'neftegaz have and therefore the actual cost of one meter of drilling of gas wells exceeded 3.4-fold the analogous indicator for drilling petroleum wells that are twice as deep (average).*

Departmental separation impedes concentration of capital investments and material-technical and labor resources for stepping up the development of facilities of the social and domestic infrastructure which are necessary for normal working conditions and a good life for the people. The critical shortage of these brings about high labor turnover and this, in turn, seriously complicates the assimilation of new regions. The normal personnel qualifications structure of the enterprises and organizations of the petroleum and gas industry is violated and the proper technical-technological and organizational level of work is not provided. This leads to a reduction of the growth rates of labor productivity, a deterioration of the quality of the facilities that are constructed, violations of efficient conditions for the technological processes of extracting petroleum and gas, and direct losses of working time.

*This is partially the result of the more difficult drilling conditions in the northern part of Tyumen Oblast (editor's note).

What Does the Association Provide?

An especially crucial aspect of the problem of creating a unified Ministry of the Petroleum and Gas Industry is determined, in our opinion, by the fact that the distribution and development of the main petroleum and gas extracting capacities have long ago entered a new and more complicated stage of their development: more and more of the deposits that are being introduced are in uninhabited, remote territories with difficult access in the European North, Western Siberia and other regions of the country, and they are more and more distant from the industrial bases and population points.

In the modern stage the task of these branches cannot be reduced simply to implementing scientifically substantiated systems for developing the deposits. Petroleum and gas workers follow the geologists and therefore they must resolve a much broader complex of problems related to the creation of both a production and a social-domestic infrastructure in the new regions.

If one traces the existing practice of assimilating and starting up new capacities, one finds that petroleum and gas workers, frequently working side by side within a single geological region, on the territory of one and the same geographical and administrative unit, and sometimes even in one and the same deposit, have to continue in the future to create their own individual production and nonproduction facilities.

Combining the country's petroleum and gas industries into one branch will lead to a situation where the entire natural complex of hydrocarbon raw material resources will have one master who bears responsibility for extracting geological supplies of petroleum and gas deposits as completely as possible. Within the framework of a powerful unionwide ministry it will be possible to create large territorial production associations and integrated (and not separate, as is now the case) petroleum and gas extraction complexes which will include all the areas of activity that are typical of this branch. It would be expedient to retain within the framework of a qualitatively new petroleum and gas extraction branch that specialization of production in individual areas of petroleum and gas work which have historically taken form and have been technologically conditioned. Moreover, in the future, it should be deepened even more as the latest achievements of scientific and technical progress are introduced. For example, the existing specialization should be retained in such spheres of activity as the transportation of the gas through main pipelines, its underground storage, the provision of gas for the national economy and so forth.

And conversely one should consolidate such presently separated subsystems as the construction of extraction and exploratory wells for petroleum and gas, petroleum industry construction, the construction of housing-municipal and socio-cultural facilities, the provision of transportation and specialized technical equipment for enterprises and organizations of the branch, material and technical supply and batching equipment, housing-domestic and socio-cultural service, branch science, protection of the resources of the earth, prevention of deterioration of natural conditions and restoration of the environment. Consolidation is a most important organizational prerequisite for

accelerated development of new territorial petroleum and gas extraction complexes and stabilization of the development of old ones, but in both cases this should be unified. For example, in the structure of the subsystem for the construction of extraction and exploratory wells one can create large drilling enterprises and technically well equipped supply bases for production and technical service for the construction of the wells which are located in the regions with the greatest development and expected expansion of drilling work.

Also of great interest is the possibility of separating the drilling sphere from the association for extracting petroleum and gas into a specialized territorial production association for the construction of petroleum and gas wells. Autonomous organization of drilling as a construction business will provide for concretization of the functions of the client (as the production association for the extraction of petroleum and gas) and the general contractor (as the production association for the construction of petroleum and gas wells or drilling enterprises that are part of it). This will contribute to the fulfillment of contractual commitments that pertain to the physical volumes, the quality and the time periods for the construction of wells. A specialized drilling association would be able to maneuver the capacities of its own enterprises, and, if necessary, sharply increase the volumes of work in certain regions while reducing them in other regions of the petroleum and gas extraction complex, while still retaining a stable volume of drilling in the association as a whole.

The creation of a unified ministry of the petroleum and gas industry will put an end to the artificial division of extracted hydrocarbons into "profile" and "nonprofile" products, which actually legalizes considerable losses of extremely valuable and irreplaceable fuel and energy resources (above all, casinghead gas). Irresponsibility in accounting for and utilizing natural fuel and raw material will be eliminated, organizational "thin spots" that arise at the junctures of the narrow departmental interests of two related branches will be covered.

Even though the advantages of the systemic approach to organizing and administering petroleum and gas extraction are obvious, a question arises: will it not be more difficult to manage an immense petroleum and gas business that is joined together within the framework of a unionwide ministry of the petroleum and gas industry? It seems that the more complex administrative structure will more than pay for itself. In particular, it will finally handle those problems which have previously been "neglected".

Moreover, as practice has shown during the rapid development of the country's petroleum and gas industry during the 1970's, no serious deviations were observed in the administration of these branches. This, in our opinion, is explained largely by the considerable improvement of the software for decision making procedures that are based on the application of branch automated control systems.

The problem of managability arises from time to time, mainly at the level of regional subdivisions in relation to the rapid growth of the extraction

capacities and the corresponding subsystems of the service industry. The large regional subdivision of the petroleum or gas extraction industry which has formed randomly over many years and has gradually become difficult to control is divided into smaller territorial production and economic complexes which are balanced in structure and size--production associations for extracting petroleum (gas). Thus in 1977 the administrative structure of the petroleum industry of Western Siberia, which had grown to immense dimensions, was reorganized. On the basis of several enterprises that had been separated from Glavtyumen'neftegaz the Tomskneft' production association was created. At the same time four production associations for extracting petroleum were created: Nizhnevartovskneftegaz, Surgutneftegaz, Yuganskneftegaz and Uralneftegaz. Four years later, in April 1981, a fifth production association was created in the system of the main board--Noyabr'skneftegaz.

The organization of the country's petroleum and gas industry within the framework of a unified branch would obviously require the development of a general administrative scheme. A serious fundamental approach would make it possible to solve this complex scientific and production problem comprehensively, on a modern scientific and methodological level.

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MATURING OF SOVIET ECONOMY REQUIRES INFORMED, ADAPTABLE ENTERPRISE ECONOMIC MANAGEMENT SERVICES

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 53-64

[Article by I. I. Usacheva, candidate of economic sciences, chief of the planning and economics division of the Krasnyy Oktyabr' Metallurgical Plant (Volgograd): "The Economic Service of the Enterprise and the Economic Mechanism"]

[Text] The work for improving the economic mechanism at enterprises and associations is organized and coordinated by the economic service. Therefore the success of this matter depends to a significant degree on its capabilities. In turn, the capabilities themselves are determined by the position of the service at the enterprise, the level of skills and occupational training of its personnel, and their ability to utilize modern methods and advanced experience as well as administrative technical equipment. Of great importance is the organization of its interaction with other services of the enterprise (association) with the corresponding functional subdivisions of the branch and territorial administrative agencies and with external organizations.

At the beginning of the 1960's the economic services of the enterprises underwent fundamental organizational restructuring. Laboratories for economic research and information computer centers appeared. Traditional planning divisions, having expanded their activities because of such new jobs as price setting, technical and economic analysis and justification, organization of intraproduction autonomous financing, fund formation and economic incentives, began to be called planning and economic divisions. The tasks of the financial divisions were complicated since the role of financial levers increased--credit, profit, interest, and payments for funds. It became necessary to coordinate the work not only of the traditional economic divisions, but also of the subdivisions of production-technical and commercial services in order to reach the given level of directive indicators. The position of head economist appeared at the enterprises (with the rights of a head specialist or deputy director). Thus an attempt was made at an organizational formation of the economic service.

The changeover of industrial enterprises to new methods of planning and economic stimulation, which was carried out in keeping with the decisions of the September (1965) Plenum of the CPSU Central Committee, relied significantly on the economic

services of the enterprise which had been formed by that time on a new organizational basis.

But life does not stand still. Seventeen years have passed. The country's economy has entered the period of developed socialism. The national economy is now being reoriented toward intensive methods of development and the achievement of final results with reduced expenditures. The external ties of the enterprises have become more complicated: in the beginning there were changes in the quantity and geography of the suppliers and the structure of cooperation, and ties with science were significantly expanded; in the end there was an increased number of clients and greater requirements were placed on the organization and time periods for deliveries as well as the quality of products. Significant changes have taken place in the production and technological structure of the enterprise. A whole generation of personnel have been replaced. Social factors play a larger and more significant role in economic growth.

All this could not but be reflected in the content of the labor of the plant economist. Nontraditional areas of application of his professional knowledge appeared--the automated system of control of production and social administration. Changes also took place in traditional areas--in forms and methods of planning, technical and economic analysis, economic stimulation, and organization of labor and wages.

Now, when work is being done to improve the economic mechanism on the basis of the decisions of the 26th CPSU Congress and the decree of the CPSU Central Committee and the USSR Council of Ministers of 12 July 1979, it seems that the economic service of the enterprise must have certain creative capabilities which will make it possible to conduct the necessary organizational and methodological work in this area. Therefore it is natural to raise the question: How prepared are the economic services to carry out these new tasks? As an example let us consider the changes in one of the plants which in 1966 was among the first 43 enterprises of the country to change over to the new methods of planning and economic stimulation. During the past 3 five-year plans the production volume here doubled. The number of kinds of products also doubled. The number of their consumers increased by 30 percent and amounted to 2,300 within the country and 30 abroad. The plant annually fills about 15,000 orders. At the same time profound changes have taken place in the production and technological structure of the enterprise. The value of fixed industrial production capital has increased 3-fold.

Now let us consider the changes in the economic service. From 1963 through 1975 its block, headed by the head economist (deputy director for economics) included: a planning and economics division (PEO), a financial division (FO), a division for organization of labor and wages (OOTiZ), a laboratory for economic research (LEI) and normative research (NIL), an information computer center (EVTs), and shop personnel--economists and norm setters.

After 1975 the OOTiZ was transformed into a division for scientific organization of labor and administration (ONOTiU), and the NIL became a laboratory for scientific organization of labor and administration (LNOTiU). The number of

personnel of the former subdivision decreased and in the latter it increased by 1 person since the position of sociologist was created there. In 1976 both subdivisions were transferred to the jurisdiction of the head economist and along with the personnel division (OK) and the division of technical training (OTO) formed a new service under the leadership of the deputy director for labor and personnel.

In the new block the laboratory for scientific organization of labor and administration existed for some time as an independent subdivision and then was merged with the ONOTiU. Bookkeeping was centralized. In 1980 the main bookkeeping office was removed from the jurisdiction of the head economist for accounting methodology. The number of personnel remaining in the subdivisions of the head economist changed. In the PEO it decreased by 13 percent and in the financial division--by 12 percent. The IVTs was transformed into a division of the ASUP.

As a result of the repeated reorganizations of the service of the head economist, there were violations in the coordination of the administration of the enterprise's economy. The solution to the interconnected problems is now being worked on by the service of the head economist (methods of planning, organization of autonomous financing, automated processing of administrative information), the service of the deputy director for labor (economics of labor, organizational structures of administration) and the technical service (the comprehensive system of product quality control, including technical and economic aspects of administration).

Such a structure of the economic service is certainly not a unique phenomenon. "In a number of plants economic work is still not concentrated under unified management as is the case with technical activity, which is managed by the head engineer."* In the opinion of other specialists, the creation of independent economics laboratories has not justified itself.

In spite of the existence of standard staff structures and normatives of numbers of personnel, there is no homogeneity in enterprise economic division of similar types.

Thus, at some ferrous metallurgy industries the price bureau is part of the PEO and at others it is included in the LEI while in still others it exists as an independent subdivision. The same thing is true of the bureaus of economic analysis.

The numbers and structure of the economic divisions at enterprises of various branches are incommensurable, which is related not so much to branch peculiarities as to the inadequacy of the very criterion of the normative of numbers: it is the volume of gross turnover and not the volume of information resources processed and stored in one subdivision or another. Hence the question: Is this diversity of structures not an impediment to the implementation of a purposive program for improving the economic mechanism?

*Samborskiy, G. I., Sheshukova, T. G., "Ekonomicheskaya sluzhba predpriyatiya v usloviyakh ASUP" [The Economic Service of the Enterprise Under the Conditions of an Automated System for Control of Production], Moscow, "Ekonomika", 1977, p 6.

Let us turn our attention to one detail. As of today one can use for a standard the organizational structure of administration at the Volga Automotive Plant. There the block, headed by the deputy director for economics, includes the same divisions that existed at the enterprise considered above 6 years ago. Suggestions are being made that the changes, like the aforementioned irregularity of the structures of economic services, are the result of subjective decisions.

Since the structure of the service and its functions are not determined, the role of the head economist appears quite vague. Some consider this role to be that of an advisor and a methodologist, whose main task is to find ways of increasing the economic effectiveness of his production and to prepare the appropriate methodological developments. Others say that the head economist (deputy director for economics) should bear full responsibility for the economic indicators of the enterprise (production association) and therefore along with the director (or in his place) the head economist should be held accountable to the higher organizations. And at some enterprises the position of the head economist is considered to be generally superfluous and they have either not introduced this position or they have abolished it.

There is no delimitation of the duties and responsibilities of the head economist and the managers of the corresponding divisions of the economic service for the condition of the organization of planning, labor and wages, the analysis of production and economic activity, work for improving the structure and methods of administration and other constituent parts of economic work.

The arrangement of economic work at the enterprise is determined to a significant degree by the interaction within the administrative unit "director--head economist" (or deputy director for economics). Frequently there is no clear delimitation of rights and responsibilities between them.

"The historical situation has taken form in such a way that we have an immense number of director-engineers, . . . the Americans have a colossal number of manager-economists, and in second place are lawyers. But there are not so many engineers in charge of enterprises."* Under these conditions the position of head economist at the beginning of the 1960's was introduced as a unique addition to the engineering and organizational capabilities of the director.

There are also managers who do not deal with and are not interested in the economics of the enterprise, and the head economist can be a person without a specialized economic education. There are enterprises like this in every city. At the same time, try to find an enterprise where the engineer does not have a specialized technical education!

A couple more ideas about the composition of the economic services, their appearance and the fate of the plant economist.

In recent years in industry there has been a new wave of graduates of economic VUZ's who are armed with modern knowledge, economic and mathematical medals and the ability to enter into dialogue with an electronic computer. While 20 years

*EKO, No 5, 1975, p 138.

ago the diploma of an engineer-economist indicated that 43 had been awarded in the institute of the discipline, of which only 6 (15 percent) were economic institutes, among today's graduates 18 (50 percent) out of 36 come from economic institutes, including 4 (11 percent) from economics and mathematical institutes.

What has changed at the enterprises because of this? At the plant which we used as an example the composition of the planning and economic service, including the shop economists, has been renewed by 20 percent in the past 5 years (the situation is approximately the same in other economic subdivisions). In the majority of cases the adaptation of today's young economist does not take long (2-3 months), and within a year he is working as well as the veteran whom he replaced. But there is no overall growth of creative potential. Why does this happen?

The content of the labor of the PEO economist has changed appreciably with the introduction of electronic computers into administration. He has practically no accounting operations. But he has not been able to use this free time in creative labor since a large amount of preparatory and documentation work has remained on his shoulders. Moreover, he must perform work which increases in volume and becomes more complicated each year for price-setting, economic stimulation of product quality, planning and so forth.

Thus, for example, while before 1967 the level of prices for rolled ferrous metals was mainly determined by four quality indicators (the GOST or the technical specifications, profile, dimensions and make of steel), in the price lists for 1967 and 1976 there were more than 20 quality characteristics whose fulfillment (lack of fulfillment) was stimulated by the corresponding additional payments (discounts). In the 1982 price list the number of positions of these additional payments was increased to 730. An entire system was introduced for calculating prices and increments that stimulate the assimilation of new, highly effective kinds of products.

In the 1982 plan the same ton of rolled metal was given four wholesale prices, and was evaluated in normative net output and also in terms of coefficients of labor-intensiveness in order to reduce it to conventional tons.

The standard methods for developing the technical and industrial financial plan for an enterprise in 1966 recommended 44 norms as mandatory, and in 1979--56.

The flows of external technical and economic information have become more complicated and increased in volume. At various times of the year the enterprise sends this to 10 agencies of the territorial administration and each month to 3-4 "upper levels" of branch administration. Numerous questionnaires from various scientific research and design institutes are filled out each year.

There is a certain irregularity in the organization of the flows of external information that gives rise to a considerable volume of routine operations at the enterprises. Thus the processing of accounting data on electronic computers makes it possible to obtain a machine document that contains the necessary information for drawing up the monthly report of the metallurgical enterprise

concerning the production of rolled ferrous metals. But the established standard form for statistical reporting is intended for manual processing and therefore the information from the machine document is transferred to a blank form that contains 2,640 lines and is sent to 3 addresses. At the same time this same information is transmitted from teletype printouts to the branch computer center.

Another example. The forms of the annual (five-year) plan for production do not correspond to the forms of the technical and industrial financial plan, although they contain indicators that are identical in content (and frequently in purpose). It takes 2-3 hours of the time of the plant economist to transfer the latter from one form of the draft of the plan to the form of the technical and industrial financial plan (and at large enterprises there can be no less than 10 of these forms).

Thus as of today when the enterprises are changing over to a new and better economic mechanism, the irregularity and lack of definition of the organizational structure of the economic services and the disorder of the functions of the flows of technical and economic information are a serious impediment in the operation of the enterprise.

To refine and bring order into the structure and functions of the economic service of the enterprise seems useful for two reasons. In the first place, bringing order into the elements of its internal structure will make it possible to improve one of the constituent parts of the economic mechanism at the level of the main production unit--enterprises and associations. In the second place, bringing order into its external ties will make it possible to determine the service's position in the overall system of administration and in the utilization of economic methods of administration.

The economic service has various kinds of external and internal ties. On the one hand, it takes instructions from the branch and sub-branch that arise from the main directions of the economic policy of the party and the state, thus fulfilling an important role in conducting this policy locally. On the other hand, being a partner of the production and technical services, it engages in the organization of production, the change of newly created value and the fulfillment of distributory functions at the enterprise.

Distribution in terms of labor causes the economist to surround his working position with special concern--it is a point where all the products and all the service functions necessary to society originate. Hence such areas of the economist's activity as scientific organization of labor and wages, material stimulation, the creation of conditions for economizing, the search for reserves for development and renovation of production and, consequently, the disclosure and support of the most effective directions for scientific and technical progress and the creation of economic conditions for the acceleration and achievement, in the final analysis, of the enterprise's major goal.

Of the three well-known production factors the most complex is the labor force. The economist is interested not only in man's degree of skills, but also in his level of public awareness--a factor which largely determines the results of

production. Therefore, the economist actively enters into the process of its formation, participating in the dissemination of economic knowledge.

Science and economic practice have developed an arsenal of means that enable the economist and the business manager to "observe" the process of growth of the mass of labor as the object of labor advances through production, to participate actively in this process and to regulate it in a given direction. This includes an entire area of economic indicators, limits, norms and normatives, levers and stimuli, methodology, methods and technology of administration.

All of the aforementioned peculiarities of the situation of the economic service at the enterprise create another area of its activity--organization and direct control of the enterprise's economy. The specific functions in this area are current and long-range technical and economic planning, bookkeeping and statistical accounting and accountability, technical and economic analysis, autonomous financing, and improvement of structures and methods of administration. Consequently, all parts of the economic mechanism must be under the control of the enterprise's economic service.

The economic service, like the services of the production and technical subsystem of administration, should be headed by a deputy director. His sphere of influence should include the following divisions: financial (control of external relations, contact with the commercial service), planning and economic (the head subdivision of the enterprise with functions of technical and economic planning and analysis, statistical accounting for production), organization of labor and wages, automated systems for control of the enterprise (organization of administration, automated processing of information), and the head bookkeeper (head subdivision of the enterprise for accounting and accountability).

Such a composition of the economic service of the enterprise will make it possible to maintain in the zone of its administrative influence not only the basic, but also other kinds of activity of the industrial enterprise (capital construction, housing-municipal and subsidiary business, and so forth). It seems that to single out any arbitrary totality of subdivisions from the aforementioned complete makeup of structural units would mean a violation of the interconnections and, consequently, a reduction of the quality of administration (efficiency, precision, completeness of the inclusion of functions, and so forth).

Several conclusions follow from what has been said.

First, the structure and functions of the economic service of the enterprise should be of the same type for all industrial enterprises, regardless of their branch jurisdiction. They cannot be arbitrarily reorganized.

Second, the economic service as a major agency in the subsystem for control of the economic activity of the enterprise is the "right hand" of the director in conducting the party economic policy, beginning with the development from below of indicators of the state plan. It makes management decisions on the basis of alternatives that are developed by specialists of the service, actively utilizing all the levers of the economic mechanism, whose adjustment at the level of the enterprise is also the responsibility of the service, in order to achieve the main goal of the enterprise.

Third, since the economic service exerts influence on the achievement of the main goal of the enterprise through creating the corresponding economic conditions, the criteria for evaluating the activity of this block of administration should be the quality of the plans, the degree of difficulty of the planned assignment, the degree of substantiation of the plan as a result of the utilization of engineering calculations and the system of scientifically substantiated norms and normatives, the degree to which intraplant subdivisions of the enterprise are included in autonomous financing, the degree to which workers are included in brigade forms of organization and payment for labor, the degree of automation of information processing, and the effectiveness of systems of material incentives and economic stimulation that are applied.

Such a placement of accents will make it possible for the manager of the service--the head economist--to organize at the enterprise goal-oriented work for improving the existing system of administration of production and organization and payment for labor--the initial stage in the overall complex of measures for improving the economic mechanism. He has a right to enlist branch scientific research and design organizations in this work on the basis of economic contracts, which, in turn, will not only raise the scientific level of plant developments, but will also greatly simplify and accelerate the restructuring of the economic mechanism in the branch (sub-branch). It seems that under these conditions it is also logical for the head economist to be responsible for the implementation of measures that have been earmarked for improving the economic mechanism at the level of the enterprise (as the head engineer is responsible for technical progress at the enterprise).

But with any degree of delegation of authority in the area of control of the economy, the director cannot avoid responsibility for the final results of the operation of the enterprise entrusted to him. "Discussion is general, but responsibility is personal," said V. I. Lenin.*

But still do we not place too great a load on the shoulders of the head economist and the service of which he is in charge? It seems to us that we do not. But there can be various opinions as to how actually to impose this responsibility. We wanted to express our own viewpoint about a question which, it seems to us, is extremely crucial today.

*Lenin, V. I. "Poln. sobr. soch." [Collected Works], Vol 44, p 165.

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VARIOUS FORMS OF ORGANIZATION IN MANAGEMENT CONTEXT EXPLORED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 65-82

[Article by G. A. Kulagin: "The Director's Daily Life"]

[Text] Georgiy Andreyevich Kulagin was born in 1912 in Odessa. After finishing the tekhnikum he worked at Kuznetskstroy as a master and a shop mechanic (1931-1934). Then he served in the Pacific Ocean fleet. From 1938 through 1944 he worked at a Leningrad metal plant as an engineer, head mechanic and chief of the administration of capital construction. At the end of the war he was chief of staff of the authorized state defense committee on the second and third Ukrainian fronts. During the first postwar years he worked as chief of the economic division of the Soviet section of the allied commission in Austria (Vienna). He participated in many conferences for developing postwar peace agreements as an expert and advisor.

From 1951 through 1964 he was chief of production and deputy head engineer of the Leningrad metal plant. From 1964 through 1974 he was general director of the Leningrad Machine Tool Association imeni Ya. M. Sverdlov. At the present time he is a senior scientific associate of the Leningrad Financial and Economics Institute imeni N. A. Voznesenskiy. He does teaching work and acts as a publicist in the press. He was chosen as a delegate of the 24th CPSU Congress and was a member of the section on machine building of the committee for Lenin and State Prizes.

According to statistical data, labor productivity in our industry in 1981 exceeded 55 percent of the level achieved by U.S. industry. This still appreciable difference, in my opinion, is explained not only by the different levels of technical equipment. Several years ago Leningrad turbine builders, having visited a number of American plants of the same kind, upon their return said with amazement: "There is nothing special--it is approximately the same machine tools, the same technology, the same speed of cutting" I myself when visiting many plants of the FRG, Sweden and Japan have repeatedly

been convinced that our machine building plants in terms of the composition and quality of the fleet of equipment are little different from foreign ones. Our engineers and workers are just as good as their foreign colleagues in terms of skills and experience.

Apparently structural and organizational factors play a more significant role in this remaining difference between levels of productivity. It is known that our enterprises are extremely universal in nature because of inadequately developed specialization, and that there are especially large losses because of the imperfect intrafirm and intraplant organization. I am deeply convinced that the reserves that lie in the organizational and administrative sphere (the possibility of better utilization of equipment and material and labor resources) are considerably greater than those that lie in improvement of technical equipment and technology.

In recent years we have taken much greater interest in organizational and administrative knowledge. More and more new departments for improving skills are appearing, where mature industrial leaders are sitting down at school desks, taking textbooks into their hands, studying psychology, playing business games and mastering mathematical methods of administration. The number of information computer centers and automated control centers is increasing like an avalanche. There is no shortage of textual aids, books, other aids and articles that treat various aspects of production administration. The authors of the majority of these works are theoretical scientists of domestic VUZ's, scientific research institutes, and also foreign business schools and universities. The "captains" of our industries themselves deal with these subjects much less frequently. And they, as a rule, have something to say. Thus there arose the idea of considering problems of administration of the Soviet enterprise from the standpoint of practice, which has merged into a series of articles that are presented to the EKO readers. I am not up to systematically reviewing the various doctrines and schools of the science of administration with respect to the conditions of socialist production and, moreover, frankly speaking, I agree with those foreign managers who state that in our day administration of the modern enterprise is still more of an art than a science. And this is no wonder since the science of administration is relatively young and its recommendations are sometimes contradictory, for the main object of administration is complex and contradictory--modern man in modern production. Therefore I have had to limit myself to recalling a few, but, in the opinion of the author, quite ingrained and fully justified points of the science of administration and to try to discuss their practical utilization.

For consideration on the pages of this magazine I selected such problems as principles of administration, the selection of an efficient organizational structure, the formation of a production plan and control over its implementation, the technical policy of the enterprise, the interaction with social organization and democratic principles in administration. And, finally, the personality of the manager and his work style.

In my advice I have proceeded from the actually existing legal and economic conditions in which the manager of the Soviet enterprise works today, and I have tried not to touch on the critical problems related to improving our economic

mechanism as a whole, since I consider this to be a subject for a separate discussion. I should like to give advice that can be acted on under today's conditions.

And one more stipulation: my experience is limited to enterprises of the machine building profile with series and small series production and therefore it is far from universal.

I shall be glad if some of these recommendations are of benefit to those managers of enterprises who have come to replace our generation.

The Organizational Structure of the Enterprise

Optimization of the organizational structure of the enterprise is, perhaps, one of the most important and complex tasks that must be carried out by the manager. A correct structure of the administrative and technical staff is the skeleton which supports well-arranged interaction of all subdivisions of the collective, stable document circulation and intelligent utilization of modern computer equipment. In a word, without this one cannot control the enterprise effectively.

The most general and basic requirement for any organizational structure is clearly formulated in the accountability report of the CPSU Central Committee to the 25th CPSU Congress: "The essence of organizational questions, simply speaking, consists in that each engages in his own business, having the necessary rights for this and bearing complete responsibility within the framework of them. This elementary rule of life is at the same time the underlying basis of the science and practice of administration."

The modern science of administration provides a certain minimum of rules that have been tested in practice, which make it possible to arrange the structure of administration taking into account the dimensions, profile and character of production of each enterprise. But before speaking about the profile and the peculiarities of a specific enterprise, it is worthwhile to recall certain of the most general rules.

One of the first (and the oldest) requirements is: one cannot arrange the organization to accommodate the capabilities of the available people; it is necessary to construct it as an instrument for achieving a clearly designated goal and to select people who are capable of providing for the achievement of this goal. Let us say directly that in life it is not easy to follow this rule. It is well realized primarily in newly created enterprises. Everyone is familiar with the great effectiveness of the organization of AvtoVAZ. It seems that the introduction of a truly scientific structure of administration at this enterprise was possible not only because of the intelligent organizational plan and the strong will of its first manager, Viktor Nikolayevich Polyakov, but also because of the fact that the collective was formed from the beginning here, mainly of young specialists and workers who were not burdened with an extreme load of traditions. The situation is different at old plants, and the more so in large associations that have been created purely administratively and are sometimes a conglomerate of various kinds of enterprises which have not reached an understanding of the unity of their tasks. Here, even if the direction of

the restructuring is fairly clear, it is necessary to deal with the history, traditions, customs and, finally, living people, whose interests are inevitably involved in any large restructuring. This is perhaps why the organizational structures of many of our enterprises are not so much the product of a scientific approach as the result of random factors, for example, temporary decisions relating to important one-time assignments and sometimes to the necessity to "add" a worker who has been released but is deserving.

The manager of an old enterprise or a newly created association must have a great deal of courage and conviction that he is right, and sometimes he must be fairly rigid in order to adhere to the first commandment: to arrange the organization without respect to people.

Of the other recommendations of the science of administration I should like to single out on the basis of my experience the following most important principle toward whose observance one must strive when developing an organizational structure.

The principle of unified management. A classicist in the science of administration, A. Fayol' correctly noted: "A body with two heads is a monster." The need for unified management is not usually disputed by anyone, but in real life this principle is violated more frequently than any other. Of course, unified management should not be understood as absolute authority of one individual, as the right of the leader to consider only his own ideas, without paying attention to anyone else. On the contrary, any serious decision requires collective judgment. But only one person should implement it and be responsible for this implementation. The essence of unified management is reflected best of all by the rule: One person should not be accountable to any more than one supervisor and should receive orders only from that same supervisor.

The principle of specialization in the sphere of administration: all regularly repeated actions should be strictly distributed among workers of the staff and should not be duplicated. When drawing up provisions and job instructions it is dangerous to forget and leave certain duties unassigned to anyone and, on the other hand, it is equally dangerous to assign them to two people "as a guarantee." In the latter case each of the two workers will hope that the other one does it and neither one will do anything.

The principle of the range of administration, that is, strict limitation of the number of people or subdivisions under the jurisdiction of one supervisor. The fact is that the load on the manager increases geometrically as the number of subordinates who are independent of one another increases. The number of possible differences among them and, consequently, requests for decisions on the part of the supervisor, calculated according to the well-known formula of Greykunas, with four subordinates is equal to 44, five--100 and 15--245,970!

Of course this does not mean that all these disagreements in fact arise; we are speaking only about the probabilities of their arising which increases catastrophically with an increase in the number of subordinates. The need to limit the range of administration was understood long ago by the army, one of the oldest organizations. In ancient Rome it was constructed on the principle of "sixes": six maniples constituted a century, six centuries--a cohort, six

cohorts--a legion. Napoleon arranged his troops on the basis of three: three platoons--a company, three companies--a battalion, three battalions--a regiment, and so forth. The majority of modern armies are arranged on the basis of three-four subordinate subdivisions.

For industrial enterprises it is usually recommended to have 6-12 subordinates, with the exception of the team of the master worker where it is permitted, when there are brigade leaders, to have several dozen subordinates.

Many practical workers, among whom I include myself and the author, think that the problems of many large enterprises are brought about precisely by overloading their higher management, particularly directors, in connection with the gross violation of these recommendations which have been tested by time. This is explained by outdated instructions that are based on the principle of direct responsibility, and also the desire of many managers of the middle level to be under the direct jurisdiction of their chief. Sometimes the directors themselves, suffering from a lack of confidence and overestimating their human capabilities, try to take responsibility for all problems themselves.

I know one large association in which the general director is in charge of 17 deputies and chiefs of divisions, and the head engineer even has 28--and this is in addition to the shops which are only formally under the jurisdiction of these two managers. It is no wonder that one of them has already gone into the hospital twice with heart disease.

Frankly speaking, the principle of the range of administration is violated not only at many enterprises, but also at higher levels of our economic mechanism. Therefore it is appropriate to recall the accountability report of the CPSU Central Committee to the 24th Party Congress: "Every unit of administration should engage in its own business so that the higher levels are not encumbered with a mass of current affairs that distract them from the large problems, and the lower levels should resolve on the spot those problems that come within the realm of their competence."

The delimitation of the number of hierarchical levels in the structure of organization. Naturally, every unit of the staff should operate under the control and guidance of a higher one. But the number of units (levels) should not be excessive. "Trees do not grow to the sky," this Fayol said. Our practice and foreign practice confirm that there should not be more than four-five levels between the manager of the enterprise and the worker. Otherwise the passage of information is slowed up, it is frequently distorted, efficiency and reliability of administration are forfeited and, expressed in technical language, the system begins to get out of hand.

It is not difficult to see that the two principles--limitation of range and number of hierarchical levels--contradict one another. It is always possible to reduce the number of levels by increasing the number of subordinates, and vice versa. But then one inevitably jumps from the frying pan into the fire. This is why in recent years many theoreticians and practical workers in administration have thought that the limit on the number of workers in a modern industrial enterprise is 7,000-10,000 people. Abroad one finds a clear departure

from the construction of universal giant plants, and the existing large firms are divided into specialized divisions which have a considerable degree of independence.

In spite of the existence of immense industrial corporations, the small, but deeply specialized firms are also maintaining their positions. Let us give several figures for illustration. While the number of industrial personnel of an independent enterprise (association, plant or factory) in the USSR averages 830, in the United States it is only 80. Even in such highly concentrated branches of American industry as automotive construction and turbogenerator construction, the average number of workers in one plant does not exceed 5,000 and 2,000 people, respectively. At one machine building enterprise in the USSR there is an average of 1,630 workers, while in the FRG it is only 250.

And so the larger the enterprise, the more difficult it is to control it. Extremely frequently the advantages obtained in a large plant from increasing the scale of production and utilizing more modern technical equipment and technology are absorbed by the losses related to excessive centralization of administration, the cumbersome bookkeeping structures of the administrative staff and the sharp increase and complication of information flows.

The contradiction that has been described can be partially resolved by delegating authority, that is, by having the higher supervisor transfer authority and responsibility for resolving repeated problems to his subordinates, in other words, by the observance of a simple rule: the supervisor should never do himself what can be done by a subordinate.

But then the decisions of subordinates who are independent of one another can conflict, the more so since people in any organization are inclined to place their own job goals above common goals. The production supervisor strives above all to fulfill the plan, sometimes not taking into account either the expenditure of wages or the quality of the products. The chief of the division of labor strives above all to save on the wage fund and not to exceed its average level, without thinking especially about how this will be reflected in the plan. The chief of the technical control division, in turn, is concerned about the quality and the absence of complaints, and overexpenditures of wages and the fulfillment of the plan do not directly concern him. Nonetheless it is necessary to delegate authority, and the lower the level to which it is transferred, the better. But the higher supervisor must attentively make sure that these "local" tendencies do not prevail at the enterprise.

If it is still necessary to choose between increasing the number of subordinates and increasing the number of hierarchical levels, my personal experience shows that the former is the greater evil. Losses caused by excessive centralization of the administration of the enterprise and the delay of important decisions caused by this cause more damage than the slow passage of information through the long hierarchical chain or when not quite optimal decisions are made independently by subordinates. Even if a director increases his own labor productivity 10-fold, this produces one-tenth of the advantage that would come if each of 10,000 members of the collective were to increase productivity by only 1 percent. Convincing evidence of this is the success of the brigade

organization of labor which is known to everyone. The development of democratic foundations in production certainly does not contradict unified management if it is correctly understood, and any organizational structure should take this into account. Modern workers and engineers do not want simply to follow orders --they want to participate in the development of decisions that pertain to the enterprise. A good production climate is not an empty concept, and it can be created only through confidence in subordinates, openness on the part of the manager and a lack of fear of individual conflicts which are inevitable in a large collective.

In conclusion, some practical advice on work related to improving the structure that is in effect at an already existing enterprise.

This job should be taken on only if the manager of the enterprise himself is profoundly convinced that it is necessary and feels each day that the old structure has become a serious impediment to further progress of the enterprise. It is useful to enlist an authorized consultant (organization or individual) who has experience and success in similar work: a view from the outside can sometimes help to understand internal problems better. The consultant should establish contact with the manager of the enterprise and have constant access to him. It is not a good idea to entrust this matter to a second-rate worker.

In the process of the work it is necessary to gather the opinions and suggestions of a broad group of workers at the enterprise whose interests in one way or another will be affected by the earmarked restructuring. This will be possible only if the workers are convinced that the management seriously intends to carry out the restructuring and that their opinion will be taken into account. Nor should one begrudge time for consideration of preparatory suggestions. It is necessary to persuade opponents or, at least, give them the opportunity of expressing their opinion. For any reorganization involves the position and prestige of many influential staff workers and it is necessary to achieve the support of the majority of them if not unanimity.

A Difficult Decision

Three main types of organizational structures have taken form in industry:

linear-functional;

production, which is sometimes called administration by productions or products;

program-special-purpose and its project or matrix modifications.

What are the peculiarities of these structures? What is the area of application of each?

The most widespread, one might say the classical, structure, on the basis of which the majority of our associations, plants and factories are controlled today is the linear-functional. Here all administrative personnel and the rest of the engineering and technical personnel are divided into two categories: linear, consisting of administrators in the narrow sense of the word; and

functional, consisting of specialists who perform particular, clearly defined functions.

Line personnel are responsible for all aspects of the activity of their subordinates who have various specialties, and also for the final result of their joint labor. The master, shop chief and director are responsible both for the program and for the quality of products, wage funds, discipline, organization of competition, fire safety and many other things.

"Functional" workers are responsible either for their own personal work or for the work of a group of specialists who perform the same kinds of functions--designers, technologists, planners, lawyers and bookkeepers.

The purely linear organization is the simplest and clearest, but it can be applied only in organizations with a small staff, with little division of labor, for example, in transportation and loading agencies, artists' studios, student construction detachments and so forth. On the other hand, organizational structures with primarily a functional basis can be effective in large organizations, but under the conditions that their profile is stable, the technology of the work performed is stable, and the interconnections among individual units of the level are permanent, for example, in the post office, in financial institutions, in the railroad and in civil aviation. Functional organization requires careful development of instructions and provisions, does not allow individual restructuring, and is not adaptive to innovations.

Linear-functional organization is called upon to combine the advantages of both principles and to ease their shortcomings. It provides for division of labor and specialization in the sphere of administration, and also retains the authority and power of line managers. But this takes place when the "functional" workers perform only the staff functions assigned to them, and the decisions they have prepared acquire force only after approval by the supervisor of both the given service and the subdivision that will carry out the decision that has been made.

But as technical equipment develops, the concentration of production increases and, in particular, large interbranch associations are created, the negative aspects of this structure are felt increasingly strongly.

Functional services are extremely divided and they multiply rapidly. In my memory, from a single division of the head mechanic they formed that of the head mechanic, the head power engineer and the head architect. A unified technical division branched out into a head technologist, a head metallurgist, a head welder, and a division of standardization. Before the war we had neither divisions for scientific organization of labor nor economic and sociological laboratories nor head metrologists nor quality control nor many other present-day functional subdivisions. I repeat: to a large degree this flood is brought about by objective requirements of the age of the scientific and technical revolution, but one cannot but note that it significantly complicates the multitude of poorly controlled horizontal links among divisions that are not under one another's jurisdiction.

The "divergence" of subgoals increases and the number of coordination meetings and conferences multiplies. The higher leadership is overloaded and delays the necessary decision. The "functional" workers begin to assume command functions. The principle of unified management is violated and the lower line personnel sometimes do not know whom to listen to. Perhaps this is why it is now so difficult to find a capable young engineer who wants to become the supervisor of a section or shop.

Once in a training session for commanders I explained to the supervisors of shops and divisions the minimax theorem. I note in passing that it is extremely useful when training with cosmonauts is done not only by specialists who are brought in from the outside, but also by supervisors of the higher level themselves--the general director and his deputies. In the first place, the students immediately understand that the training is a serious matter and, in the second place, the "generals" themselves must increase their theoretical knowledge and, in the third place, it becomes clearer who is worthy of what.

And so I asked the supervisor of a smelting shop how he understood the theory of minimax. "It means," he answered, "that the production supervisor demands that I immediately 'cover' the castings for my own shops . . . the commercial director promises to have my head if I do not deliver the smelting for cooperation first . . . the head engineer demands that I provide smelting for the plan for new technical equipment tomorrow . . . well, and the head economist takes away the shop's bonuses if the plan for tonnage is not fulfilled . . . each has his own strategy, but I do not know which strategy will be accepted by you, the general director, and what you will punish me most severely for . . . and, naturally, I cannot do everything all at once . . . and so under these circumstances I must select my own strategy, guided by the theorem of minimax. Right?"

"Quite right!"

"And here I thought that Filonov's brigade formed foundation slabs that were not at all crucial since the models were available, and the rates for them were advantageous"

The listeners laughed, and now it was my turn to think.

The harmful consequences of multiple management that arise from the extreme functional division of the central staff of the ministry are also felt by the directors of the enterprises themselves, who sometimes receive the most contradictory instructions from each of the six or seven deputy ministers and managers of the numerous functional administrations.

This is probably why in recent years it has not been easy to find intelligent people willing to take directors' posts either. I note, incidentally, that the agencies that handle staff and financial problems for some reason think that line personnel are "not mandatory" and strictly control the number of masters and shop supervisors, but allow many functional subdivisions to develop almost unlimitedly, especially if they are involved with technical equipment or fashionable undertakings. Is it not time to recall again the old instructions of our party concerning the need to strengthen unified management and fight against departmentalism and impersonal management?

It seems that now the linear-functional structure retains its advantages and can be used successfully only at enterprises of small and medium size, and of the large ones, only in those which produce a single kind of product which rarely changes. These are enterprises of the dairy, baking and cement industry, and metallurgical and petrochemical plants. But here too it is necessary to avoid breaking down divisions. On the contrary, one must proceed boldly toward consolidating and combining them.

At large multiprofile enterprises of machine building and instrument building branches, where there are frequent changes in output, in our opinion, the linear-functional structure is becoming obsolete. It is effective only at the lower and middle level of administration (shop, production) where production conditions are relatively stable and the activity of the personnel takes place within the framework of the existing division of labor.

This is precisely why during the 1970's both here and abroad, as production became concentrated and was combined into large autonomously financed complexes that sometimes produce various kinds of products, the product structure began to be widespread. Its essence consists in that the enterprise is divided into a number of relatively independent, but narrowly specialized productions. Under the jurisdiction of the director of such a production are not only the corresponding shops, but also the functional services, either all of them or only the technical and production ones. In the former case the production is given maximum operational and autonomous financing independence, and the management of the association handles long-range and strategic problems: the determination of the profile and program, the system of planning and accounting indicators, capital investments and overall control. In the latter case the production (branch, division) is responsible for new developments, technical preparation for production, output of products, service for the consumer, and all the other external relations, including supply, sales and personnel and domestic services, are handled by the central staff of the association.

I should like to emphasize especially that with both variants it is necessary to ensure the autonomous financing integrity of the firm, which is reflected primarily in the unity of the corporate body, the plan, the balance and the bank accounts. Unfortunately, today we frequently see the opposite phenomenon. Many newly created production and, particularly, scientific production associations strive primarily to centralize the administrative staff, but still they retain the legal and financial independence of the production units, continue to include external circulation in commodity output, retain separate financing and complete autonomous financing of design bureaus and scientific research institutes included in the association, and so forth. Experience shows that it is precisely in these that one finds excessive accountability, the responsibility of the production units decreases, and their economic interests continue to be separated.

The advantage of the production structure consists in the reduction of communications and flows of information, in the more complete observance of the principle of unified management, in the proximity of the decision-making centers to the people who execute them, and, finally, in the removal of trivial current problems from the higher echelon of management. The shortcomings include a certain increase in the staff and duplication of the duties

of costly specialists in parallel services of individual production. It is precisely because of this shortcoming that I once had to withstand no small amount of pressure from the proponents of centralization of the staff in order to retain design and technological services among the plants that became part of the Leningrad Machine Tool Building Association. I think that my position with regard to this question was fully justified by life, for the closer the developers and production workers are on the territorial and economic planes, the more quickly new products will be assimilated and the fewer the mistakes that will be made during their creation.

The experience of American firms is interesting in this respect. In the 1960's, because of the appearance of computers and the exaggerated hopes placed on their role in the sphere of administration, there was a marked tendency towards centralization of the administration of large firms on the basis of linear-functional structures. At the end of the 1970's this tendency was reversed.

An investigation of 500 of the largest corporations showed that only 70 of them, which produced one or several products of the same kind and were also at the end of the list in terms of the number of personnel and the total sales, maintained centralized structures. And the overwhelming majority of the firms, including all large and multiprofile firms without exception, changed over to the production structure. We note that all the large Soviet associations are close to precisely these largest American firms in terms of the number of personnel and the degree of diversification of production.

Even at the present time VAZ, GAZ, KamAZ, Svetlana, Uralmash, the Izhorsk plant and many other Soviet associations are successfully applying the product structure or are preparing to change over to it. Let us discuss only two of them.

The practice of the VAZ was approved by the government and described in detail on the pages of EKO. Therefore let us recall only its special features. Although this association essentially produces only one product or, more precisely, several modifications of the automobile on a general design basis, its main plant is divided into five productions. The association also includes four branch plants that have autonomous financing independence, the RemstroyMontazh trust, the Avtotekhnobsluzhivaniye administration and a large housing and municipal services facility. The directors of the productions and the branch plants have been given all production and technical functions except for research, development and external relations. Four-fifths of all engineering and technical personnel and employees are in the production staff. The general directorate has been relieved of the task of solving current problems and has concentrated its attention on external relations and long-range prospects. Additionally, the production shops which retained essentially only line personnel, were also relieved of all concerns except for the output of products and the education of the collective.

The Leningrad Svetlana plant operates successfully year after year. This multiprofile association produces generator and semiconductor instruments, electronic and X-ray equipment, and it has its own machine building production. They have created five scientific production complexes which are fully

responsible for research, development, technological preparation and series production of products. There is a clear-cut production structure with elements of project-special-purpose administration. This has made it possible for Svetlana not only to consistently increase the volumes of production, but also to reduce the time periods for the assimilation of innovations to one-half-one-third of the previous level. The degree of loading of the higher administrative level is clearly shown by the fact that only 15-20 people attend the operations meetings of the general director of Svetlana, instead of 100-150 as is the case at other enterprises of a similar scale. And the operations meetings proceed much more rapidly and in a much more peaceful atmosphere.

Structures based on project-special-purpose methods of administration and their plan or matrix form. The essence of these consist in that, in addition to line and functional supervisors, the staff includes a category of so-called supervisors of projects. These people, providing the link along the horizontal, are like minor general directors and are given the appropriate authority and resources (the right to distribution, wage funds and bonuses, and so forth). They are temporarily assigned the necessary specialists from any subdivision--from researchers to production workers and merchants who are engaged in the sale of the final product. Thus the rank-and-file worker comes under the authority of two supervisors--his own permanent one and the temporary one who is the supervisor of the project.

A variety of this method is the matrix structure, whereby the supervisor of the project dictates to the functional or line supervisor what he should do and when he should do it, and the latter himself decides who is to help him and how to carry out the assignment. Here there is no clear violation of unified management, which is inevitable with a purely project structure.

But with any variants of program-special-purpose administration it is important to have mutual understanding and observance of the balance between the influence of the manager of the program and the permanent supervisor.

The question of priorities when several programs or projects are being carried out simultaneously is not at all simple either. It seems to me that it is not without reason that one American manager called project-matrix organization a very fragile structure. Apparently program-special-purpose administration can be applied most successfully in scientific production associations and scientific research institutes when several innovations are being assimilated at the same facilities at the same time, and also in VUZ's when solving comprehensive scientific problems and it is necessary to combine the efforts of many departments and laboratories.

Planning institutes long ago introduced the so-called GIP's (head engineers of projects). But in the majority of the cases they were not given any real authority or financial resources, and their influence on the specialized divisions of the institute is extremely small, and therefore they themselves frequently become "right-hand men" and "reporters" to the management about the failure to meet one deadline or another.

The program-special-purpose method can provide a great advantage at new enterprises that are in the stage of development and establishment, as is shown, for example, by the practice of the KamAZ.

As for associations and plants with an established production character, the application of such methods, in my opinion, is not widespread and will apparently inevitably be eliminated to particular tasks for assimilating new products, for carrying out reconstruction and for fulfilling extraordinary assignments. The author of these remarks has twice had occasion to play the role of manager of a program even before this term was known. The first time was before the war doing emergency work to organize a technical school. Within three weeks it was necessary to organize three dormitories and two shops, to install more than a hundred machine tools, to transfer the base of the plant vocational and technical training institution, and so forth. The second time it was necessary to assimilate an extremely complicated item of new technical equipment. Many shops of the plant and outside organizations were enlisted to carry out this task.

In both cases the unconditional priority of the task over all other ones was determined and the board of directors gave extensive authority to enlist the necessary people and wages, and to allot the necessary equipment and any necessary materials.

It seems that in order to apply program-special-purpose methods and structures successfully on the scale of the enterprise, it is necessary to observe those conditions that were correctly discussed at the October (1981) Plenum of the CPSU Central Committee with respect to large programs of national economic significance: "It is necessary to have a system of control of the program which clearly establishes personal responsibility for each part of the work and gives the necessary rights. Without this the program is not a program, but a sum of individual wishes."

Thus the selection of one of the three standard organizational structures or a combination of them depends on the specific conditions for the operation of each enterprise. And only its managers can find an optimal solution to this most important problem.

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ROLE OF COMPREHENSIVE TRANSPORTATION NETWORKS IN REGIONAL DEVELOPMENT

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[Article by P. M. Polyanyan, candidate of geographical sciences, Institute of Geography of the USSR Academy of Sciences (Moscow): "Multi-Arterials and Distribution of Production"]

[Text] One can perhaps not find a better analog for a transportation system than the blood circulatory system in the organism. Reticular, that is, formed of lines and their junctures, the transportation infrastructure penetrates a territory, serves all spheres and branches of the national economy, and thus plays a vitally important system-forming role. The "general state" of the economy depends directly on its condition. It is therefore not without interest to see how the transportation network reacts to increased intensiveness of shipments, how it, with all its inertia, adapts to new requirements.

We are speaking about one of the most interesting phenomenon in the transportation system--the tendency toward multi-arterialization. Just as urban complexes are increasingly replacing cities that were separated from one another, multi-arterials--a qualitatively new and potentially more efficient kind of channels of communication--are coming to replace single-transport arterials (but being based on them, similar to the way urban complexes "grow out" of a large urban nucleus).

Arterials and Multi-arterials

Arterials are the main lines in the communication network: they occupy the upper levels in its functional hierarchy and are distinguished by the greatest capacity to handle traffic.

One should distinguish two major functions of arterials--transit and service. As a transit channel the arterial cuts through the territory, orienting large through cargo and passenger flows. In its service role it serves as an element of the local communications network, covering a region and serving mainly its internal needs for shipments.

The process of forming and developing arterials, which is predictable during the course of the scientific and technical revolution, is called arterialization. Along with electrification and energy production regionalization, arterialization

was one of the main parts of Lenin's GOELPO plan, a part of the system of measures for overcoming the colossal territorial distance between the raw material and industrial regions of Russia. Arterialization can be regarded as a form of concentration of transportation activity.

Along with arterialization, a special (and historically new) form of linear concentration is multi-arterialization, that is, the combination of various types of parallel general purpose and specialized transportation lines into bundles that are close together and run in the same direction--multi-arterials (PM).¹

The distinguishing features of the PM are the approximately parallel lines of various kinds of transportation and the division of functions among them, the fact that they augment one another in the areas where they come together (including joint stations and junctions), the extensive possibility of combining arterials and nonarterials and the possibility in principle of selecting the most suitable type of transportation in each case. The operation of the PM is considerably more advantageous than that of a single arterial because of specialization and cooperation of the kinds of transportation that constitute the PM, the combined line service and the increased reliability of shipments (in case of an emergency or repair of one of the lines). On large arterials and PM's administrative boundaries of one level or another practically do not hold up the cargo flow. "Parallel utilization of several kinds of transportation reduces operational expenditures up to 15 percent as compared to shipments on the railroad alone. This savings pays in a relatively short period of time (less than 5 years) for the production capital of other kinds of transportation that are operating in parallel with the railroad," thinks one of the authors who has investigated this issue.² The ordinary "concrete wall" along the main gas lines that are being constructed in the North is capable of sharply reducing the time periods for their construction (and particularly compressor stations) as a result of the elimination of seasonality and irregular rates of work, and it also facilitates the operation of gas lines and makes it less expensive.

In spite of its undoubted effectiveness, the PM is not always formed in a planned and purposive way. The formation of a PM is among those problems with which the barrier of departmental separation appears on the path of a systematic economywide strategy. A typical example: "Along the route of the BAM a wide highway is being constructed which is necessary for constructing the strip of railway. About 300 million rubles will be spent on it. In the future, of course, the Ministry of Transport Construction will not need it. But without it it is impossible to assimilate the natural resources of the BAM zone. It is clear that we should spend a little more money and transform this temporary route into a permanent one for motor vehicle drivers. GlavBAMstroy is prepared to construct this road, but it needs a client and money. The problem has gone unsolved for 5 years already."³

There are functional differences among multi-arterials that arrive from their makeup and structure. Thus the common kinds of transportation (rail, automotive, river, sea and air) serve as key and first-stage factors in economic assimilation of a territory and subsequent spreading of innovations.

From the historical standpoint rivers are especially important as natural axes for settlement. But river and railroads are rigidly determined (their influence is confined mainly to ports, docks, junctions and stations). In the work that was cited A. I. Fadeyev writes that even in the northern regions "... since after the war multi-arterials are beginning to spread out from the river valley and the automotive highway is becoming their basis ... the existence of a parallel highway (the Alaskan highway) played a decisive role in selecting the route of the gas line from northern Alaska to other regions of the United States."

In recent years there has been a steady increase in the role of pipelines as components of the PM, and not only liquid substances, but also solid ones are transported along pipelines. Thus after the Lelo-1 pneumatic container pipeline was tested for 3 kilometers (for transporting crushed stone and other construction materials) south of Tbilisi in 1980, a longer (17.5 kilometers) and larger pneumatic pipeline, Lilo-2, went into operation from Marneuli to Lilo. It took almost all the load of large, but short-distance shipments from the parallel railroad. With the startup of the second section of Lilo-2 the annual volume of shipments will increase from 225,000 tons to 2 million tons of crushed stone. The large group of problems related to pipeline transportation deserve special consideration on the pages of the magazine.

The main type of PM is rail-highway. In the first place the two kinds of transportation are most significant in the modern structure of transportation; in the second place, it is precisely their interaction in the area where the means of transportation come together that is especially promising. As practice shows, the most economical are the largest cargo rail shipments over short distances, which can be carried out with incomparably more advantage by automotive transportation. Each year the volume of these shipments exceeds 120 million tons or 3.5 percent of the overall shipment of cargos by rail transportation. To transfer them to automotive transportation--on highways that run parallel to the railroads--is extremely effective: the average speed of deliveries of cargos increases 10-12-fold, and production costs decrease to one-twelfth-one-twentieth of the usual amount. Rail and automotive PM's also have great potential in the sphere of passenger transportation.

The Scale and Criteria of Multi-arterials

Three traditional geographical scales are applied to the analysis of the PM: macro, meso and micro.

On the macro scale the multi-arterial (for brevity we shall call it macro-PM)--this is the traditional joining of the largest interacting matrices of population or industrial centers, for example, Moscow and Donbass, Moscow and Sverdlovsk. All kinds of transportation without exception are important here, including air transportation which provide for high-speed passenger and postal communications (and in recent years, to an increasing degree, production ties). The most important thing here is polytransport communications and not the direction of the route. Transportation lines can diverge from one another for many dozens of kilometers without internal links and, consequently, do not directly interact. Their direction on individual sections can diverge even at a right angle (as, say, the Volgograd Highway and the Volga River). Nonetheless in a certain sense this is a PM.

Just indirect interactions and the unity of final goals is not enough to define meso-poly-arterials. On the meso scale the distances between the components of the PM do not exceed 10-15 kilometers, and in exceptional cases--20-25 kilometers. On sections with this kind of divergence it is absolutely necessary to create road junctures (as a rule, automotive, but sometimes rail). The meso-PM means a great deal for the territory through which it passes: it involves both intra-oblast and intrarayon distribution points for commodities and local products, local and suburban passenger flows, and links with regional centers. On the other hand, local territorial peculiarities (both natural and socio-economic) exert an extremely strong influence on the meso-PM's, primarily on the configuration of their routes.

On the micro scale the infrastructure lines of the PM pass right next to one another, beginning with the minimum distances between them that are allowable by technical safety and ecological-sanitary norms, and ending with a 5-10 minute walk between them (that is, 1.5-2 kilometers).

Each real PM, while combining the features of various scales and representing the complex unity of them, as a rule, is drawn toward one of them in particular. Therefore the various scales of the PM can legitimately be regarded as special types of them. Extreme natural (tundra, dessert) and socio-economic (unpopulated, sparsely populated areas of the route) conditions contribute to bringing the lines closer together at one point, that is, to the formation of a microscale of the PM. Such, for example, is the automotive-rail Trans-Mid-Asiatic Multi-Arterial from Krasnovodsk to Chardzhou, whose lines diverge from one another somewhat only within large oases. And a similar influence is exerted by the degree to which the route of the PM is physically crowded (in a narrow river valley or a mountain gorge, in the strip between the sea and the mountains, and so forth), which forces the lines to come right next to one another, even if the socio-economic conditions of the territory do not require this. Such arterials can be found on the seacoast. On the other hand, considerations of a strategic nature make it necessary to combine the tying up and "securing" of the lines in the bundle with their territorial separation and isolation.

Multi-arterials in the Territorial Structure of the Economy

Multi-arterials, just like single arterials, reflect the direction not of all, but only of the most important economic ties, which makes them effective only with high intensiveness of traffic and developed structures of production and consumption in the regions and centers that are joined together.

Arterialization and multi-arterialization will thus serve as a means of economic transformation of space--bringing together centers and regions that are served by the network and, consequently, will be one of the leading factors in the formation and development of the territorial system of the national economy. Combining transit and service, the PM will serve as a kind of pivotal point for the crystalization of the economy and as its skeletal axes. In the final analysis it will contribute to the formation of more or less discontinuous (and sometimes also continuous) belts of economic development that are supported on these axes. It is not by accident that B. Malish called the PM's "lifelines." The position of the PM, especially in the internal interval between its components, say,

between the rail and automotive roads, is known to be advantageous for all industry or agricultural production that involves shipments of raw material or final products.

Why is it particularly the PM and not the separated transportation lines (say, ordinary highways) that will become this kind of crystallization axes for the economy? For many industries this situation is exceptionally advantageous, and sometimes it is vitally necessary. Among them are primarily those which need not just one, but two or more kinds of transportation (most frequently automotive and rail). They need a functional juncture of transportation and technological processes.

Elevators can serve as typical examples of this kind of enterprise. It is typical here that the operation of two kinds of transportation do not coincide in time: the harvesting of the crops and, consequently, the "motor vehicle peak" comes in the second half of the summer, and the shipping of high-quality grain, and this means the "railroad peak" comes in the autumn and spring (before planting campaigns) and in the winter. As we can see, the conditions require precisely a multi-arterial position of the elevators, sugar refineries, canning plants and other similar enterprises.

A reverse relationship is also possible: a concentrated influx of raw material with the railroad and a dispatch of prepared products on trucks. This is the situation of many enterprises of the construction industry (plants for reinforced concrete items), the chemical industry (production of fertilizers) and so forth. One should also include among them the large bases for material and technical supply and warehouses. This advantageous situation on the multi-arterials is especially important for branches of machine building with a developed production of batching items (automotive and tractor construction). Automotive shipment of parts and components from related plants corresponds most completely to the cooperative nature of the technology of their production, while the final product is transported from the head plants, as a rule, on the railroads. The sales zone of such giants as the VAZ or the Kirov plant, ZIL or KhtZ is the entire country.

But if the essence of the matter lies only in the functional interaction of two or more kinds of transportation, why are we speaking about PM's and not about ordinary transportation centers?

If one disregards the number of advantages of the PM (reliability and so forth) it might seem that, say, a perpendicular juncture of transportation means is quite equivalent to the multi-arterial. But, in the first place, this kind of crossing is fairly rare and most of the time it has long been occupied, grown over with industries and cities, while industrial development requires more and more new advantageous areas. In the second place, the functional combination of rail transportation is important in itself, but it is still not the only factor in justifying one kind of production or another. On such an axial line as a PM it is much easier to find a place that is convenient from the standpoint of other conditions for the distribution of production as well. The PM can significantly enrich and facilitate the selection of factors and conditions that are necessary for one kind of production or another.

The evolution of transportation networks contributes to multi-arterialization, which is quite important for these same elevators. Now a large part of the grain is shipped to them on trucks on poor summer roads, which leads to large losses. It makes more sense to ship them to the arterial that is closest to the elevator; the distance of one trip might be increased, but the time of transportation is reduced (as a result of the high speed on the good road) and, the main thing, losses of grain are reduced. As selective field investigations of the elevators and grain receiving points showed, the tendency toward reorientation to good highways, most frequently along railroads, is actually taking place. To take advantage of this reorientation means to attack head on the problem of the effectiveness of various kinds of transportation networks, and from there--to the effectiveness of territorial structures as a whole.

According to the observation of I. M. Mayergoyz, old industrial regions of the GDR, Czechoslovakia and Poland, having ended up some ways away from the multi-arterials, are playing less and less of a role in economic life, giving way in significance both to new construction projects and the corresponding axes adjacent to them. Moreover, in a number of capitalist countries there is a degradation of regions that are remote from arterials or are located on secondary lines, and they are withering precisely because of arterialization.

The structure forming significance of arterials and PM's increases sharply when they serve international economic ties. Crossing borders, the arterial lines, in cooperation with local distribution lines, contribute to the formation of zones of interstate contacts and appreciably facilitate integration processes in the economy.

Multi-arterials are being studied as structural and economic factors in many countries. Thus the Polish geographical economists B. Malish and E. Dembskiy, having singled out belts and units of development on the territory of Poland on the basis of PM's, have calculated that within these belts and centers there are cities whose population in 1950 reached 83 percent of the overall number of urban residents in the city. In 1965 their proportion had increased to 87 percent, and in 1973 it approached 90 percent. It has also been established that cities located in these belts and centers have developed twice as rapidly as other populated areas. These figures, in the opinion of our Polish colleagues, serve as a good confirmation of the viability of the concept developed by B. Malish of belt-center population, which corresponds to real processes of economic development.

In other regions as well the proportion of urban population drawn to the PM is quite significant. According to our calculations, the corresponding proportion for Hungary was 71 percent in 1960 and had reached 72 percent by 1974. The figure would have been much greater if they had used the methods of their Polish colleagues (as components of the PM they used not just any highways, but only arterials and roads of the highest category).

Calculations for the Georgian SSR (using the Malish-Dembskiy method (confirmed this tendency that had been noted. While in 1970 the proportion of city dwellers living on PM's of the republic amounted to 90.5 percent, in 1975 it had increased to 93 percent, and in the Abkhaz and Adzhar ASSR's--even to 96-87 percent. On an average for the USSR approximately 50 percent of the railroad

lines have parallel paved motor vehicle highways, and on the roads of the Baltic area, the Donbass and the Northern Caucasus these lines comprise 70-80 percent.

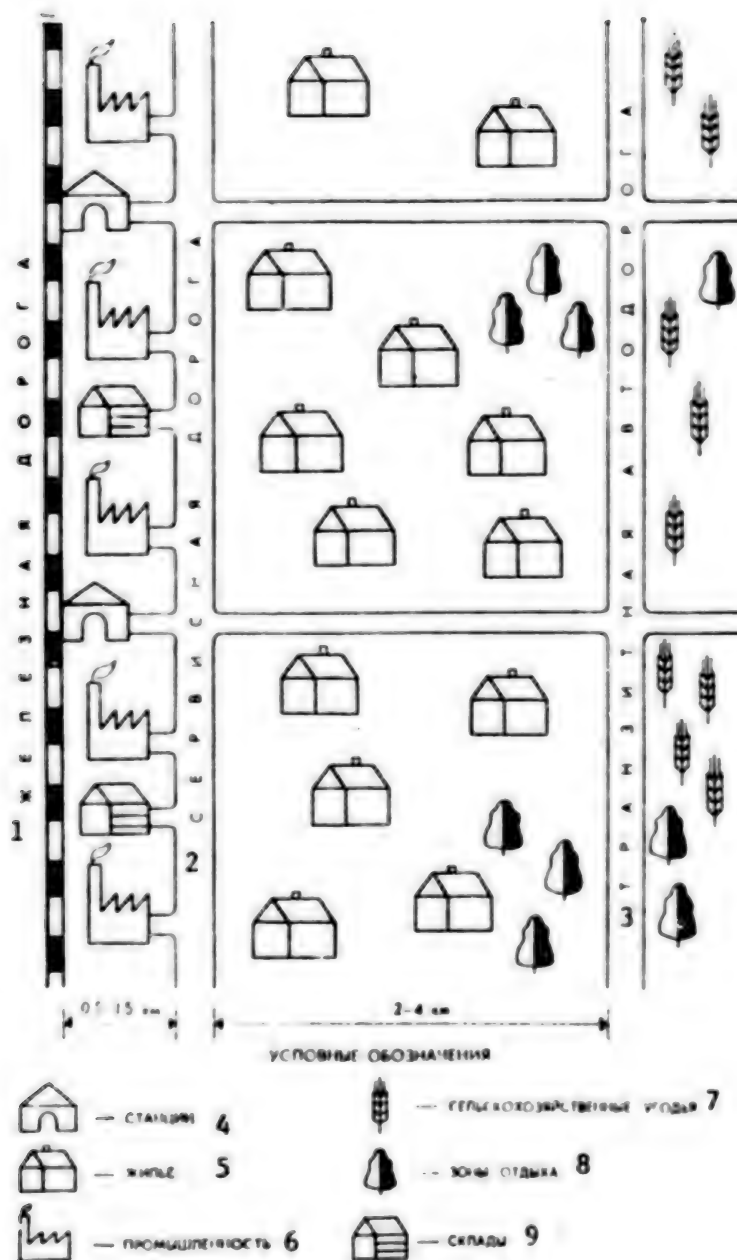
In conclusion let us give a judgment about the optimal cross-section profile of the PM or, in other words, the principle configuration for an ideal multi-arterial, whose components, for the sake of simplicity, we will limit to automotive and rail transportation. Such a PM in the matrix of economic life should consist as a minimum of three lines joined to one another by communications of various frequency. The first line is a railroad; the second--a service highway that is not far from the railroad line (from 0.5 to 1.5 kilometers) but is connected with all stations, sidings and rail terminals. The third is a transit automotive arterial with high-speed traffic; it consists of a service road at a distance of 2-4 kilometers and has several adequately large points of contact with it.

In the zone between the railroad and the service road there are enterprises and warehouse facilities which serve both kinds of transportation. Between the service and the transit road there is basically residential area, and beyond the transit road--agriculture and recreational areas. All the intersections and junctures of the components of the PM and connections among them are organized at various levels. If necessary, a similar economic belt is developed on the other side of the railroad.

A real-life example that is close to the recommended type of functional organization of the territory adjacent to the PM can be the situation that arose after the construction of the 35-kilometer road in the region of the Kazan and Tbilisi stations on the multi-arterial from Kropotkin to Krasnodar. The road took on a large transit flow of cargo between Krasnodar and the regions of the Northern Caucasus which lie to the east of Kropotkin, including all transit passenger bus transportation. In the space between the highway and railroad there are the main enterprises of the station--the elevator and the sugar refinery. The service road has been built up with residential buildings. The distance between the service and transit roads is 3.6 kilometers. The rest of the area is occupied by agricultural crops and roads with poplars planted beside them.

An extremely similar situation has arisen on the fairly long section of the PM from Rostov to Voronezh as a result of the straightening of the Rostov-Moscow highway. The highway was not only shortened, but also it became a transit highway (the route bypassed two additional intersections with the railroad). And the old highway, which passed through Novochoerkassk in the immediate vicinity of the railroad lost its transit role and now serves local needs, that is, it has become a service or feeder-distribution road.

Concentration and intensification of production, and the concomitant increased effectiveness are a mark of our age. There is no doubt that the phenomenon of multi-arterialization is also a product of this time. This phenomenon, which is becoming increasingly widespread, has not yet been studied well. Its interdisciplinary and interdepartmental nature is partly to blame for this. To overcome this it will obviously be necessary to integrate the efforts of scientists



Key

1. Railroad
2. Service Road
3. Automobile Transit Road
4. Stations

5. Houses
6. Industry
7. Agricultural Lands
8. Rest Zones
9. Warehouses

and engineers of various specialties--economists, transportation experts, geographers, ecologists and others. It would undoubtedly be fruitful to have a conference devoted to problems of interbranch interactions focused on transportation, particularly questions of multi-arterialization. It seems that a need has already been felt not so much for description and study of the PM, as for its concrete planning, regulation and administration as well as inherent tasks in its development.

FOOTNOTES

1. In addition to the term "multi-arterials," the terms "comprehensive transportation arterial," "infrastructural bundle" and "transport communications corridor" are also used in literature to designate this or a similar concept.
2. Vorob'yev, A. A., "Multi-Transport Arterials," VESTNIK MOSKOVSKOGO UNIVERSITETA. SERIYA V. GEOGRAFIYA, No 3, 1973. Referring to American sources and calculations, A. I. Fadeyev writes about this same thing: ". . . parallel construction and utilization of several kinds of transportation in the North reduces construction expenditures by 35-40 percent and operational expenditures by 20-25 percent as compared to the mono-arterial, and as a result, the construction of all lines operating in parallel pays for itself quickly."
3. PRAVDA 7 December 1979.

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INFLEXIBILITY IN IMPOSITION OF STANDARDS CRITICIZED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 94-96

[Article by M. A. Katser, chief of the division for quality, durability and standardization of the All-Union Scientific Research, Planning and Design, and Technological Institute of Electric Locomotive Construction, (Novocherkassk, Rostov Oblast): "Is It Perhaps Worthwhile to Simplify?"

[Text] The article by V. A. Bykov aroused lively interest among workers of the All-Union Scientific Research, Planning and Design, and Technological Institute of Electric Locomotive Construction (VEINII).

The main line electric locomotives that are designed in the institute are especially complicated products and are put into production with a large cycle (5-7 years). The production of electric locomotives is individual in nature. Our client--Ministry of Railways--completely determines the composition and specifications of the item, and also the time periods for the technical assignment, development and testing of the experimental model. But the developers cannot simultaneously satisfy the client, the Ministry of Railways, and the Gosstandart, even though the institute is guided by a branch standard that is coordinated with the Gosstandart and was reissued in 1979.

And how has the introduction of several systems of standards been proceeding in the past 3-4 years? We had not managed to complete the introduction of the YeSKD (Unified System of Design Documentation) when the YeSDP (Unified System of Tolerances and Fittings) appeared, and then there was a new system of units of measurement, and now there is a YeSKD classifier. All these systems must be introduced at various times and require a complete revision of design and technological documentation that exists in production. In our opinion it would be more reasonable to introduce all systems of standards at the same time and no more frequently than once every 10-15 years.

The first Soviet electric locomotives were developed and manufactured in 1932. Traditionally there have been rules about the fulfillment and designation of elements of the electrical diagrams of the electric locomotives. Thousands of machine operators were trained from them. But then beginning 1 January 1971 a new standard was introduced which established quite different rules. Our client (the Ministry of Railways) was categorically against the revision of the circuit block diagrams. But when we asked the Gosstandart about the

possibility of changing the standards or having them not apply to electrical rolling stock, we received the answer: "The requirements of the standard must be met!" And then for several years in a row there was a whole series of changes in the standards for designations of the circuit diagrams.

During 1980 alone, the change in design documentation because of newly developed and revised standards cost several tens of thousands of man-days, that is, almost one-fifth of the designers of the institute did not engage in development and improvement of the design for electric engines. In our opinion, one should prohibit changing the year of publication of the standard after the revision. It is sufficient to simply use the inscription: "Reissued in this year, taking these changes into account."

Just the list of state and branch standards that guide the selection of technical materials, instructions, methodological instructions, provisions and information letters of the ministries, which are to be used for guidance when developing, coordinating, approving and revising technical specifications for an item for industrial and technical purposes (mainline and industrial electrical locomotives) has 45 items. The developer of technical specifications is practically incapable of interpreting such a large number of documents. The Gosstandart and VNIISTandartelektro should probably think about a unified normative document which would include all requirements for technical specifications and, perhaps, would simplify these requirements.

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PRODUCTION SLACK NEEDED FOR SUDDEN, UNFORESEEN PLAN SHIFTS

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 96-97

[Article by I. A. Rozenberg, candidate of economic sciences, Institute of Economics of UNTs [Ural Scientific Center] AN USSR (Sverdlovsk): "Unit Production--A Special Situation"]

[Text] Beginning in the 1920's, that is, from the time of the establishment of Soviet organizational science, in all textbooks, monographs, departmental publications and even GOST's the main and practically the only difference between machine building production of the unified type and series and mass production have been the peculiarities of operational and production intra-plant planning. In fact this is far from the case. Unit production of large complex machines and whole complexes of machines in heavy industry and other branches of machine building and instrument building during past decades have acquired essential organizational and economic peculiarities.

Such processes as the development of designs, technological preparation of production, manufacture, assembly, authors' supervision over the operation, technical servicing, repair and modernization of machines are carried out in unity. And the control of this process should also be unified and there should be a special-purpose program that embraces all of its participants in all stages of the creation of new technical equipment. The compiler and maintainer of this program, who controls its implementation, should be the general director.

Unit production is distinguished by the fact that it is essentially indefinite since it is in operation for an extended period of time, and scientific and technical information is constantly being updated. The developers have a natural desire to update and improve their decisions. V. A. Bykov writes about this quite correctly. He refers, equally correctly, to the inertia of our system of planning, which frequently impedes the implementation of progressive decisions. For it is clear that in unit production of complicated machine complexes, whether it be a rolling mill or a line for producing mineral fertilizers with all of the related sets of equipment, everything is not developed and not envisioned immediately. And it is always the case that certain additions and changes "suddenly" show up, which must be accommodated somehow somewhere and included in the plan, overcoming somewhat's inertia. This is a property of this type of production. And it must be taken into account in our planning activity: it requires a reserve of capacities and flexibility of production.

Moreover, there should be legislatively established priority of these programs and it should be compulsory to include progressive additions and changes in the plan.

The changeover to program-special-purpose planning in unit machine building requires comprehensive accounting for expenditures of all participants in its implementation. As a result we obtain the complete production cost of the technical equipment that is being created, including expenditures on its development, technological preparation of production, manufacture, assembly and startup and adjustment work. It is especially important to take labor expenditures into account, if only in man-years, in order to obtain an idea of the level of labor productivity that has been achieved in natural indicators of products or services. But this requires making certain additions to state statistics. So far they are incapable of providing for the proposed system of accounting.

There is no need to discuss the fact that special-purpose programs, and it seems to me that there can be 100-200 of them at the same time, should be constantly in the field of vision of the USSR Gosplan and the corresponding local planning agencies.

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SLAVISH ATTENTION TO STANDARDS HINDERS EFFICIENCY

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 98-99

[Article by I. Ye. Kaplin, deputy head engineer of the Tazhstankogidropress Association (Novosibirsk): "Standards Should Not Impede Work"]

[Text] Our association produces individual items and small batches of unique planing and horizontal boring machine tools with numerical program control, and also large hydraulic presses for various purposes with up to 5,000 tons of pressure. These complicated items weigh from 100 to 1,500 tons and the cycle of their production, beginning with development, lasts 3-5 and more years. More than 500 designers are employed in the planning and assimilation of this unique equipment, and more than 200 technologists are employed in the development and introduction of the technological processes. The paradox consists in that the most skilled of them have to deal with numerous agreements, " coordinations " and " settlements " of technical specifications, level charts, information about applying bearings, hydraulic equipment and cable items, and also norms for the expenditure of materials.

Instead of rapid joint consideration and coordination of the technical plans, the manufacturer and the client spend a great deal of time on the development of orders, technical assignments and other materials. This work for creating practically unnecessary documents prolongs the cycle of planning and lowers the technical level of the individual machines that are being developed.

The YeSKD standards on the whole have brought order into the various blueprint systems that existed in various branches of machine building. But certain requirements of the YeSKD, for example, the requirement that the entries and the specifications strictly observe alphabetical and numerical order, are paradoxical. Expenditures on the development of blueprints and technical specifications after the introduction of the YeSKD increased by 25-30 percent, and this means that the labor productivity of the designers decreased. The expenditure of paper increased because of the cumbersome forms and the introduction of additional documentation.

Design bureaus of our association are not being augmented with youth, and their staff is decreasing. This is a consequence of the loss of prestige of design work and of its significance, which can lead to difficult consequences in the future.

Therefore we agree with the suggestion of V. A. Bykov concerning the organization in VUZ's of special groups for training designers, the restoration of the provisions of the order of Sergo Ordzhonikidze of 18 July 1935, and also the awarding of the title "Designer of Highest Qualifications" taking into account the planned, manufactured and introduced machines of a high technical level.

We partially disagree with the conclusions of the author about the worthless nature of branch standards that are developed by other organizations. These branch standards are necessary, and in machine building they produce a good effect.

First it is necessary to consider and deal with the questions raised by V. A. Bykov for reducing nonproductive expenditures of the time of designers.

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NEEDLESS CHANGES IN BLUEPRINTS DECRIED

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[Article by Yu. V. Bednarchuk, deputy head designer of scientific research institute of the Elektrot'yazhmash Plant imeni V. I. Lenin (Kharkov): "Do They Hear Us? Are They Paying Attention to Us?"]

[Text] Our plant delivers unique direct current electric engines that are individually made for the drive of equally unique rolling mills that are manufactured by Uralmash. Just as with them, with the introduction of the YeSKD our designer's productivity dropped sharply: the volume of paperwork and copies increased a great deal, and the entire process of coordinating technical specifications with the numerous control, coordination and inspection organizations became complicated.

The costly time of the designer is spent on preparing and filling out various forms and notifications for numerous organizations in a number of cities. He could use this time for discovering new design solutions and finding additional variants for the future machine. One cannot but recall the great monetary expenditures on business trips either (mainly to Moscow and Leningrad).

It was already noted that GOST 15.001-73 establishes equal requirements for relief to the interdepartmental commission (MVK) of items for both series and individual production. The latter are manufactured without experimental models in single units (or they are repeated once every two-four years). But still it is necessary to submit to the VNIISTandartelektro for expert evaluation the technical documentation, a chart of the technical level and a draft of the technical specifications which are preliminarily coordinated with 6-8 organizations. It is especially difficult to work with VNIISTandartelektro. Frequently one has to sit in the waiting room in front of the janitor and wait until they remember you and give an answer with compulsory remarks. Even though they are inessential the person on the business trip must return to his city, eliminate them and then return again to Moscow in order to fill out an order for a convocation of the interdepartmental commission. Sometimes these "coordinations" are prolonged and the item manufactured by the plant cannot be sent: it is necessary to gather together all members of the commission in order to receive the machine.

And they are now preparing another "attack" on the designer. They have begun to introduce a YeSKD classifier for new symbols on blueprints. The numerical designation has increased and the work has become more complicated both for the person who draws up the blueprint and for the worker of the production service who submits the assignment to the shops. We do not understand why changes are made in the blueprints we use for the same machines that are individually produced. Our plant's archives have tens of thousands of blueprints and a change in their numbers is tantamount to the labor-intensiveness of creating a large electric engine for a rolling mill.

And the last thing. In publications one can frequently find critical ideas similar to those expressed by V. A. Bykov. But we do not see even a simplification of technical documentation. Perhaps these suggestions "do not reach" the necessary levels or are rejected by them

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READER'S LETTER ABOUT TIGHTER QUALITY CONTROL VIEWED IN LARGER PLANNING,
BALANCING CONTEXT

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in
Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 101-112

[Reader's Letter and Response: "On Black and White Rubles, Khozraschet and
Balance"]

[Text] One of the indicators of the active and vital position of our readers
is their letters with concrete suggestions about how to improve one aspect of
economic practice or another. They regard improvement of the economic system
as a personal matter.

The letters and suggestions are sometimes fairly unexpected, but they are
worthy of attentive consideration and a serious answer. We offer for your
attention one of the letters that came to us from the Lithuanian SSR and the
response to it.

The question is asked by Vintsas Oskarovich Nefas, Shilute, Lithuanian SSR.

The basis of our economic life is public division of labor. Every plant pro-
duces a particular kind of product. For example, the state has entrusted a
particular staff and equipment to the director of the glass plant. Be so good
as to make glass. One must go to him for glass. But how does one know whe-
ther he performs this basic work well or poorly? It is most reasonable to
ask the consumers, for they know best of all whether they are receiving junk
or a good item. But how does one ask. One cannot contact all the consumers--
this would cost more than the glass. The consumer himself speaks up only
when the supplier becomes quite unbearable. This means that it is necessary
somehow to include the consumer evaluation in the process of exchange itself.

I suggest providing state consumers with a way of evaluating the quality--
black and white rubles in quantities that correspond to the purchasing capa-
bility of the consumer. When the consumer is satisfied with a commodity he
pays white rubles, and when he is dissatisfied (but the product is necessary
and he must purchase it)--black ones.

Then it will become clear how the director of the glass plant is working. It
is necessary to count up the black and white rubles in his bank account, di-
vide that by the quantity of the products, compare this with that of other

enterprises--and the picture is clear. No tricks used to improve the indicators will work.

The consumer will use this money to evaluate not only the quality, but also the assortment, quantity, regularity of delivery, and value, in a word, if he is satisfied--white rubles, and if he is dissatisfied--black ones.

You might ask me why not just ask the consumer of the product about its quality without any black and white rubles. Because without these kinds of money the director is motivated to conceal the truth, and it is very difficult to look into the relations between the consumer and supplier, especially when there is an immense number of consumers.

But the use of black and white rubles is not all there is to my suggestion. It is also necessary to grant more freedom to the enterprises themselves. The management policy could be as follows: the director receives the assignment which indicates the products list and the region of distribution of the products or the list of consumers. And nothing more. Based on this, the director gains a clear idea of the demand and the desires with respect to quality and assortment, and he organizes production and delivery to the various addresses, and finally he counts up the money. If there is a large number of black rubles he discovers the reason for the dissatisfaction with the product and takes the necessary measures. If there is a large quantity of white rubles he receives moral satisfaction and material remuneration.

It is necessary to relax control of the part of the state over the internal life of the plant. This will contribute to more efficient service for the consumers. Let the state control only the fulfillment of commitments with respect to deliveries, earnings and working conditions.

What advantage, in my opinion, will the society receive from the use of black and white rubles? There will be no need for a state staff to ensure the quality and quantity of products. The management of the plants will not have to expend effort in order to get around state measures for ensuring the quality and quantity of the products. There will no longer be a need to create reserves at the plants for providing for continuous fulfillment of planned assignments. It will be possible to work at full capacity without fear of increased planned assignments. The reworking of items and the manufacture of spare parts by the consumers for unadapted equipment will be reduced to a minimum, and everything will be done by the supplier where the technology is intended for the output of the given product. The prestige of Soviet industrial organizations will increase. Our plants will not be able to produce products that are obsolete or of poor quality. Their quality will be excellent and they will be available to everyone.

The head of the laboratory of the Central Economics and Mathematics Institute of the USSR Academy of Sciences, doctor of economic sciences V. L. Perlamutrov, answers.

Dear Vintsas Oskarovich!

The magazine's editorial staff has shown me your letter. It is interesting in its correct diagnosis of the relations between the producer enterprises and the consumer and in its unusual and nonstandard approach to improving them. The letter causes one to think.

As for the black and white money you suggested, in my opinion this is not a medicine for the disease. There cannot be several or even only two monetary systems in a unified economy. If they are created, they quickly merge into one. Practice will establish a conversion coefficient--for a black ruble they will give, for example, five white ones. And the manager will again be faced with a dilemma (which exists even now): to produce 100 good machine tools, 1,000 fair ones or somehow to produce some of each. This will not be a solution to the problem of effectiveness, intensification or quality.

When conducting the monetary reform in 1922-1924, in our country, which had then created one of the strongest currencies in the world, the chervonets (it was equal to a pound sterling), for some time both new and old (being removed from circulation) money, sovznaks, was used. The chervonets was equal to 10, 100,000, and then a million sovznaks, until the latter disappeared from circulation altogether.

The now deceased professor Ivan Akomovich Kirillov used to tell us young graduate students now during those years, without knowing it, he himself had acquired a new (then--the third) currency. As a specialist in insurance, I. A. Kirillov suggested ensuring policies of the citizens against devaluation of the sovznak. The matter proceeded. One could not beat off the people who wanted insurance. Suddenly they called the inventor out on to Lubyanka Street: Why, dear sir, are you undermining the monetary reform? . . . It turned out that the insurance bonds (with a set rate, like the chervonets) were being used in Sukharevka as full-value money and thus were undermining the monopoly of the Gosbank on issuing money. What is important to us now is not this episode in the biography of the professor or even the fate of the reform, but the last thing--"various colored" money inevitably merges into one monetary system. There cannot be various monetary systems in one national economy, and so there cannot be black and white money. It is not a matter of color.

It is a matter of bringing the entire economic mechanism in line with the requirements of intensification of the economy and complete utilization of the possibilities of the scientific and technical revolution. No single change (or several of them) will make it possible to do this. An interconnected system of them is needed, possibly one which is graduate in terms of the time of implementation, but the main thing is that it embrace all units and levels of production and administration: planning, autonomous financing, the rights and responsibilities of agencies for management of the economy; supply, finances, price setting, wages and credit; the national economy, its branches, enterprises--in a word, everything.

At the beginning of the century one philosopher (A. Bogdanov) expressed this idea: the reliability of any system is determined by its weakest link. If, he wrote, one moves a column of troops consisting of infantry, cavalry and artillery, the speed of movement is determined by the slowest unit--the infantry. Or, as Eastern wisdom tells us, the caravan will arrive when the last camel arrives The entire essence (and the entire complexity) of the improvement of the economic mechanism consists in that there can be no weak links. It is necessary to have true efficiency of the hour-by-hour mechanism in its work. And this produces efficiency of management.

With all this--and in this you, Vintsas Oskarovich, are right--the pivotal point for improving the economic mechanism is the enterprise (association). Because here and only here is where the products which go for consumption are produced--industrial, personal and national income. Other parts of the economy can only contribute, create the necessary conditions, and provide the external prerequisites for highly productive and high-quality work of production collectives. But even if all 100,000 enterprises had the speed of the cavalry and several thousand financial or, for example, supply agencies had the speed of the infantry, at what speed would the national economy advance?

Of course, one can only speak about the general contours of the solution to the problem that is touched upon in your letter. It seems two things are necessary above all: strong motivation for efficient activity of the enterprises and sufficient external (independent of the enterprise) prerequisites for their activity.

As for motivation, the main thing, in my opinion, is the following.

In the first place, the main activity of the association or large enterprise should apparently be financed through its own income and bank credit, which should be repaid from this same income: acquisition of raw materials, processed materials, fuel, the creation of stockpiles of incomplete production and supplies of prepared products, the payments of wages and bonuses, repair of equipment, "elimination of loopholes," and replacement of outdated equipment. This policy is usually called Khozraschet autonomous financing. In order to achieve this it is necessary to have clear-cut rules for the distribution of profit in keeping with stable normatives between the association and the state budget, and also the maintenance of internal capital. Unfortunately, stability is not always maintained. Internal monetary funds of associations are redistributed by the ministries from one collective to another (usually from those that are working well to those that are not working so well, or are simply working poorly). Thus one undermines the very basis of the Khozraschet of the association as a system of responsibility of the collective for the results of its labor, as a collective stimulus for effective management.

And another thing. Related to what has been said is the extremely beneficial existing policy for extending credit to associations. It is fairly easy to obtain a loan, and it can also be extended, refinanced for a longer period, or else even written off. In a word, it turns out that it is not mandatory to repay it precisely by the given deadline. This is something that might

be called "social security" credit, that is, its antipode. It should not exist in an economy that is directed toward intensive growth. It is necessary to change the conditions for extending credit. The conditions for granting loans should contain conditions for its unconditional and prompt repayment. Otherwise in the system of self-financing one discovers gaps of inefficiency: fill the warehouses with raw and processed material, inflate the "complete production"--Daddy will pay for it.

Self-financing is important and necessary because in this way the income and the satisfaction of the needs of the collective and its workers are made directly dependent on the results of labor, on the skills, on the attitudes toward the matter, conscientiousness and on ability. Otherwise there is an undermining of the stimuli for labor, dependence and inefficiency. In keeping with the decree of the party and government concerning improvement of the economic mechanism (1979), the majority of branch ministries are to be changed over to self-financing under the current five-year plan. The large-scale experiments of the 1970's in the USSR Ministry of Instrument Making, Automation Equipment and Control Systems and Glavmosavtotrans have convinced us of the expediency of this. It is appropriate to recall what V. I. Lenin wrote immediately after the end of the civil war: "I think that the trusts and enterprises with autonomous financing were founded precisely in order that they themselves would be responsible and in all ways responsible for making sure that their enterprises did not operate at a loss."*

Still it should be noted that self-financing of a socialist enterprise cannot be absolute. The strategic functions of large-scale expansion of production, radical restructuring, and the application of principally new technical equipment and technology come under branch and interbranch administrative agencies since they are the ones that can see the future national economic need for products and the possibilities of development and distribution of new production.

Second, about planned assignments for the enterprises. As you know, for many years a great deal of various things have been written and said about them. It seems to me that it is necessary to answer two questions: what to plan and how to give the enterprises the assignments. All aspects and parts of economic activity must be planned. And to the second question, it seems, one must answer this way: to assign them in such a way and only in such a way that they upgrade and do not break down Khozraschet interests of the enterprises and to give them space for action (of course, under the condition that these interests consistently correspond to national economic ones).

We have become accustomed to a situation wherein planned assignments come to the enterprise as purely administrative ones: the volume of gross output, commercial sales, normative net output, products list, assortment, profit with non-normative distribution between the enterprise and state budget, production costs and so forth. With maladjustment of economic levers it is precisely this that leads to well known consequences: the struggle on the part

*Lenin, V. I., "Pol. sobr. soch." [Collected Works], Vol 54, p 150.

of the enterprises to make the plan easier, violations of the assortment, poor quality, a desire to obtain more raw materials, processed materials, capital investments and labor force, and an avoidance of technical innovations.

Yet our country has its own experience in combining planned assignments for enterprises and their Khozraschet interests: the work experience of state enterprises during the 1920's.

One can submit this policy. Everything is planned, taken into account, compared and calculated by the planning agencies. The state planning assignments for volumes of production and deliveries of products are transferred to organizations of Gosstab, Goskomsel'khoztekhnika, the Ministry of Procurements and other supply agencies. They are also given the necessary circulating capital. These organizations, as good buyers, distribute orders in the branches and at the enterprises and conclude economic agreements with equal rights. In essence, the relations amount to the following: you, the enterprise, produce and sell me this product at the established price, and I will purchase it and pay you on time and fully. These are normal Khozraschet relations: for the producer--to sell, for the consumer--to buy. If the state order does not embrace all production capacities of the enterprise it has a right, under a direct agreement with other consumer enterprises, to arrange supply and sales relations with them.

Supply agencies, also on a contractual basis, organize the supply of raw materials, processed materials and semimanufactured products for the enterprises. Not white and not black money, but an agreement with the corresponding encouragements and sanctions for fulfillment or violation of contractual conditions.

Now about the prerequisites for effective management that are external to the enterprise or association. The circumstance that they are precisely prerequisites, contributory conditions, is certainly not an indicator that they are secondary, of lesser importance and so forth. A fur does not get warm in the winter, it only creates the prerequisites, but without it you cannot withstand the frost. Is it secondary?

The most important thing here, it seems to me, is the following.

Above all, balanced development of the national economy, strict--both in the plan and in the course of its implementation--correspondence between needs and capabilities, production capacities, raw material resources and working hands, the production of interconnected branches and many other things. But primary and prior to all of this is balance of material and monetary resources of the national economy (professor V. D. Belkin wrote about this in EKO, No 3, 1982). Only with balanced development of the economy there is no "dictatorship" of the producer ("whatever I make they will accept it, regardless of how I make it they will also accept it"), but he has good and necessary concern--to work in such a way that his products are accepted.

It is extremely important to determine in the national economic plan and maintain during the course of its implementation the quantitative correspondence, the coordination of the mass of products circulating in the national economy and the mass of money. For money is the right to obtain the social product. And if the rights are greater (or less) than the product, the normal course of economic activity is disturbed. The entire system of economic stimuli operates normally only with balance of the commodity and monetary masses in economic circulation. When this is violated it flags, dries out and loses force. Enterprises have money for construction, but they do not have enough materials, mechanisms or, as they say, the capacities of construction organizations are inadequate. The result? Lengthy time periods of construction, retardation of technical progress, overpayment of workers and losses.

In order to avoid this it is necessary to include as a mandatory part of the national economic plan the plan for the country's monetary circulation. Since the Gosbank puts monetary funds into national economic circulation, it should be responsible for all monetary circulation. As of today the responsibility is so divided among various departments that there is practically none that can be held responsible. And responsibility is needed. Only coordinated planned movement of material and monetary resources in the national economy will provide for efficient operation of the economic mechanism as a whole and such an important constituent part of it as Khozraschet.

But if the Khozraschet interests of the collectives do not everywhere and always correspond to national economic interests (reflected in the state plan) this is mainly because the system of economic stimuli is poorly related to the tasks and assignments of the plan. But this shortcoming can be eliminated.

Here is the situation. The system of economic stimuli persistently works on the assignments of the national economic plan under the condition that prices, the policy for payment for labor, the distribution of profit and other Khozraschet levers are determined on the basis of assignments and proportions of the plan itself. This has not been sufficiently achieved so far, which creates contradictory stimuli in the activity of Khozraschet units. Thus the press frequently criticizes managers for their drive to produce advantageous, highly profitable items while violating planning discipline. The criticism is justified, but it is not profound enough.

If planned prices "disappeared" from the assignments of the national economic plan, that is, the items most needed by the country have the highest profitability, then this contradiction is removed: the prices give a direct signal to the manager about his behavior, augmenting and strengthening the directive nature of the planned assignments. And when the assortment of the output of products in the plan "pulls" to one side and the prices to the other, the manager, as a rule, ends up between a rock and a hard place. He strives to fulfill the planned assignment, but . . . not fully, and he tries to increase the volumes of sales of products and profit, which depend on the price level --but also not fully. As a result both national economic and Khozraschet interests suffer, as do the interests of the matter and production effectiveness as a whole.

The system of economic stimuli is formed on a monetary basis--the same prices, earnings, bonuses, fines and so forth. In essence the system is centralized, comprised of rules established by the state for the distribution and utilization of the gross income of the enterprises and branches. It should be arranged and operate not independently, but on the basis of and along with the assignments and proportions of the national economic plan. Then the prices will be the same and will be planned prices in the complete and precise sense of the word. When prices in the plan change the system of stimuli is restructured correspondingly. This will be an effective lever for fulfilling planned assignments. Here it is important to have a direct link between Khozraschet and the plan: for economic stimuli are an inherent element of Khozraschet, the drive belts from the plan to Khozraschet. If the element is strong, then Khozraschet operates consistently for efficiency of the national economy, and the drive belts will not let it jump out of the necessary tracks.

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GDR'S EXPERIENCE IN CONSERVING FOSSIL FUELS, ELECTRIC POWER EXAMINED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 113-124

[Article by S. B. Kazantseva, Institute of Economics of the World Socialist System of the USSR Academy of Sciences (Moscow): "GDR Experience in Economizing on Energy Resources"]

[Text] The increased price of energy products did not affect the GDR as severely as it did many other countries. This is explained by the relatively small proportion of imports for satisfying the needs for energy resources and the peculiarities of price setting within the framework of the CEMA.

Among the primary energy resources of the GDR petroleum comprised 21 percent in 1979 (FRG--50 percent). The GDR is the largest producer of lignite in the world, which plays a major role in the country's fuel and energy balance. It satisfies 60 percent of the need for these resources. In 1979 they extracted a total of 256 million tons of coal and about 30 percent of the world production of lignite. In 1985 it is planned to increase its extraction to 285 million tons, and in 1990--to 300 million tons (an average annual increase of 1.6 percent).

Verified supplies of lignite in the republic now approach 40 billion tons. This makes it possible to extract it at the present level for about 100 years. Lignite is used primarily for producing electric energy and gas.

In order to provide for extracting 285 million tons of coal by 1985 it will be necessary to assimilate eight new deposits. This assimilation will be very labor-intensive because of the great depth of the covering layer of rock. It will be necessary to use productive belt conveyors more intensively. Moreover the energy supply in the GDR is susceptible to the weather. Because of the high water content (50-60 percent), coal mined in open pits freezes easily, which in the winter sometimes leads to interruptions in the supply. Not only the conditions for extraction (stripping rock amounted to 3.7 cubic meters per ton in 1970 and will be 5 cubic meters in 1990), but also the quality of the lignite deteriorates.

The gas deposits in the republic are insignificant. Each year they extract approximately 8.5 billion cubic meters, which in 1979 amounted to 3 percent of the energy resources that were consumed.

And on the whole two-thirds of the GDR's needs for energy are satisfied through their own energy resources. As compared to other countries, this is a high level of self-provision (FRG--40 percent).

Expenditures on the extraction of lignite have increased from 1.5- to 2-fold during the past decade in various regions of the country. National economic expenditures on the production of a unit of heat with gas have increased 4-fold and with liquid fuel--8-fold as compared to the use of lignite, in spite of the fact that prices of petroleum from the USSR are relatively lower than the prices on the world market. In keeping with the principles of price setting in effect within the framework of the CEMA, prices of energy products are established annually on the basis of prices on the world market during the past five years. Petroleum from the USSR costs an average of 30-40 percent less than from the OPEC countries. In 1980 the level of payment for imported oil and gas from the USSR was almost half the average price on the world capitalist market.

The national income produced in the GDR during 1971-1980 increased by an average of 4.8 percent, and the consumption of primary energy--by only 2.2 percent. True, since 1976 the rates of economizing on energy have dropped, in 1979 the increase in the consumption of primary energy (4.9 percent) even exceeded the increase in the national income. But in 1980 the high growth of production was achieved without increasing energy consumption. Within the framework of the CEMA the GDR has achieved a lower growth rate of expenditure of energy. On the national economic scale, in 1985 it is intended to double the level of the past five years in economizing on energy.

With the change in the production structure there is to be a reduction in the proportion of material- and energy-intensive branches, and with the creation of new technology--a significant savings on energy products. An essential advantage should be obtained because of the reduction of losses during the transformation of energy and its transportation to the regions of consumption.

Combine directors are primarily responsible for the implementation of the assignments of the state plan for science and technology. The ministers of the industrial branches are personally responsible in general for the fulfillment of the corresponding areas of the plan. Control functions are the responsibility of the Ministry of Science and Technology. The GDR Gosplan centrally plans assignments for the branches regarding physical indicators of the economy of energy, which must be achieved as a result of measures in science and technology. After the assignments have been approved and submitted to the branches, the ministries break them down among all 154 of the country's combines. The combines independently resolve all financial and organizational problems related to the fulfillment of the assignment. This motivates the combines and enterprises to utilize the latest achievements of science and technology.

Because of the large amount of housing construction it becomes especially important to have efficient heating of the premises. The energy balance should be relieved because of the expansion of heating networks, which provide heat for the housing of 13 percent of the country's population. By 1990

water will be the main means of carrying heat, and the heating network will be expanded. The production of thermostats will increase, which will make it possible to regulate the temperature in the premises better.

The state plan has assigned the GDR Academy of Construction the following task: by 1990 to achieve an average of a 30 percent reduction of the proportional expenditure of heat for heating all residential, public and industrial premises. This is tantamount to saving 10 million tons of ordinary lignite. With comprehensive housing construction it is intended to reduce the consumption of heat by an average of from 7 to 5.3 kilowatts per apartment. The solution to these problems begins with the development of elements of walls and windows with optimal heat insulation and efficient equipment and technical devices for heating and ventilation, and ends with automatic regulation of the input of heat and an optimal temperature in the premises. It has been calculated that more than two-thirds of the necessary amount of heat that is to be saved will be achieved as a result of improving the thermal insulation of roofs, windows and outer walls of buildings, and one-third --through efficient heating and ventilation systems and the utilization of alternative sources of energy (solar collectors, heat pumps and heat regeneration installations).

The GDR expends 15 percent of its energy on transportation. Almost half of this amount is expended on railroads. Because of the changeover to diesel and steam locomotion, the railroad consumes 25 percent of the diesel fuel resources. This makes it possible to save a significant quantity of electric energy. The ratio of energy expenditures among electric, diesel and steam locomotion is now 1:2:7. With the help of accelerated electrification of the railroad it will be possible to achieve more efficient expenditure of energy, to create possibilities of utilizing domestic lignite, and also to increase the handling capacity of the railways by 15 percent because of higher speeds of electric engines as compared to steam and diesel locomotives. In the republic 11 percent of the railroads have been changed over to electricity. In 1981-1985 each year 159 kilometers of the railroad network will be changed over to electricity. Other CEMA countries have achieved significantly greater success--in Poland 27.1 percent of the railroad network operates on electricity, and in Hungary--16.6 percent.

There are reserves for economizing on energy sources in automotive transportation as well. In 1980 the country will reduce the expenditure of diesel fuel by 4.4 percent as compared to the preceding year even though the volume of shipments has increased.

Recently the GDR adopted a decision concerning norm setting for the expenditure of fuel and the norms are differentiated depending on the makes of the machines.

Under the conditions of the prolonged price increases on the raw material markets, the problem of efficient utilization of secondary raw material is becoming increasingly critical. Secondary resources in many respects are now being planned and balanced centrally. Capital investments in obtaining secondary raw material produce an effect that is four times greater than

comparable capital investments in the production of primary raw material. At the end of 1980 the GDR adopted the "Decree on Expansion of the Utilization of Secondary Raw Material" which also envisions intensive utilization of secondary energy resources. The collection and utilization of secondary resources constitute a primary task for expanding the domestic raw material base. The commissions for the utilization of secondary raw material have been given the responsibility of checking on the observance of expenditure norms. The utilization of primary raw material is allowed only if sources of secondary raw material are fully exhausted. The enterprises received planned assignments for the collection and utilization of secondary resources.

Great successes in the utilization of secondary raw material have been achieved, in the first place, as a result of purposive comprehensive scientific research on the effectiveness of repeated utilization of secondary resources; in the second place, because of correct organization of the matter, and, in the third place, because of extensive and profitable publicity of the importance of the problem. It is intended to balance secondary energy resources with analogous primary ones; to fully take into account and extensively utilize secondary energy resources; and to provide for complete responsibility for the delivery of secondary resources.

In recent years heat produced by neighboring electric power stations and industrial enterprises has been used increasingly frequently for cultivating hothouse vegetables and accelerated raising of carp. A centralized program is being developed for the utilization of discharged energy.

Each year the GDR removes from operation 65,000 tons of tire coverings that have served their time. Of these 10,000 tons are used as fillers for asphalt concrete paving. The Berlin tire plant has conducted testing on the utilization of old rubber as fuel in cement furnaces. One kilogram of old rubber (the coating of one passenger vehicle tire weighs about 8 kilograms) emits 8,000 kilocalories during burning. The same quantity of rock coal emits only 5,000 kilocalories during burning. Because of the high temperature in the furnace the soot, which has a rubber mass, also burns, which prevents pollution of the atmosphere. The tests showed that the cement plants in the cities of Doyn and Rudersdorf can annually use 10,000 tons of old tire coating, which will make it possible to save 32,000 tons of rock coal. This savings will fully cover the expenditures on the development of special technology for preparing and burning tire coatings in cement furnaces.

A significant national economic effect and appreciable savings on petroleum is produced by gathering used motor and industrial oils and processing them into lubricants. The country uses petroleum as the main raw material for producing lubricants. Another initial material is tar which is obtained when coking lignite. In 1980 the Second National Conference on the Utilization of Processed Oil was held in the GDR. It approved the instructions and suggestions for gathering, delivering and processing used oil. The influx of used oil is constantly increasing: 1975--61,900 tons; 1976--64,900 tons; 1977--72,300 tons; and 1978--74,000 tons. Recently the drafts of the national economic plans have begun to include assignments for gathering used oil in a volume of about 30 percent of that which is expended.

Lignite ash occupies an important place in utilized wastes. The utilization of ash at electric power stations has proved to be effective. One thousand tons of burned-out ash can replace approximately 600 tons of unprocessed lignite.

All branches of the national economy have been enlisted in the utilization of secondary energy resources. Thus timber specialists in Waren have found a useful application for scrap timber. They have created a machine that is capable of transforming sticks and branches into chips that are convenient for consumption. The chips are now being sent from this business to boilers of local animal husbandry complexes. Timber wastes weighing 2,900 kilograms replace one ton of boiler fuel oil, and 1,300 kilograms replace one ton of lignite briquettes. Instead of one ton of sorted lignite it is sufficient to have 607 kilograms of chips.

Normatives for consumption, changes in prices and purposive capital investments also contribute to economizing on energy. For energy-intensive equipment, products and technologies the country has developed 550 normatives for the consumption of energy which act as standards and correspond to the world level. The revision and introduction of new norms for expenditure are carried out at the enterprises no less frequently than once a year.

The public norm setting collectives that have been created at many enterprises of the GDR render a great deal of assistance in scientifically substantiated norm setting for the expenditure of energy and materials. The managers of the enterprises are obligated to account to them for the introduction of normatives for the expenditure of materials and energy that have developed.

Beginning 1 April 1980 new limits for the expenditure of energy resources were introduced and general directors of combines were made more responsible for planning and accounting for sources of energy, applying state limits on the expenditure of energy, and especially for developing and applying scientifically substantiated norms for the expenditure of energy. Outlays on energy sources, fuel and other combustibles are planned at the combines and enterprises only in keeping with the amount of the limit. Only for a few kinds of energy-intensive products it is allowed to plan additional outlays. Then the unutilized limits should be returned within the corresponding quarter. If the limits are exceeded fines are imposed in the amount of ten times the release price. The introduction of limits and sanctions makes it incumbent on combines and enterprises to develop and apply progressive norms and to observe the strictest economy in the expenditure of energy. These measures provide for unified responsibility for the production and consumption of energy and at the same time create the best prerequisites for comprehensive work in the area of energy management in the combines. New decrees which recently went into effect envision not only the introduction into the state plan the indicators of the delivery and expenditure of energy, but also their revision. The decrees contain provisions concerning accounts of the consumption of energy sources and control over them. It is not allowed to exceed the quarterly limits for the expenditure of energy and surpluses formed as a result of changing operating conditions are to be removed.

Since 1981 the combines and enterprises have been developing and approving as constituent parts of the production plan a plan for the production and expenditure of energy and a plan of measures for efficient utilization of energy. This increases the possibilities of the general directors of combines and the directors of enterprises to influence efficient application of energy resources. The combines develop plans for the production and expenditure of energy on the basis of state limits, norms and indicators that correspond to the world technical level and submit them to the ministers for approval.

A large effect is expected from the annual increase in prices for electric energy, thermal energy and solid fuel which is envisioned before 1985. Since 1976 the GDR has been revising wholesale prices for energy, raw materials and machine-technical items. Beginning 1 January 1981 88 decrees went into effect for another increase in wholesale prices. A large part of the increases involved energy sources. Domestic prices for imported energy products have been increased significantly. It is expected that all this will contribute to utilizing mainly local fuel and to economizing on it. Increased wholesale prices stimulate efficiency and energy engineering. The changeover to domestic energy products is advantageous to the enterprises since expenditures on the utilization of regular lignite or lignite briquettes are 75-66.6 percent lower than on the utilization of high-calorie natural gas or fuel oil translated into heat supply. Moreover retail prices remain unchanged as a result of state subsidies. For example, the price of one kilowatt-hour is 8 pfennigs, which covers only half of the actual expenditures on the production of electric energy.

The development of long-term concepts of the development of energy engineering for a period of 15 years contributes significantly to efficient utilization of energy. They determine the main tasks for efficient expenditure of energy and the optimal utilization of energy products from the national economic standpoint.

The Central Energy Commission, created in 1979 as an agency of the GDR Council of Ministers, plays a key role in the coordination and fulfillment of all national economic tasks for expanding the energy base and developing the efficient utilization of energy in the country. It includes ministers or their deputies from all branch ministries, members of the Gosplan management, the Ministry of Science and Technology, the committee for worker and peasant inspection, the vice president of the Academy of Sciences and representatives of other agencies. The Central Energy Commission studies comprehensive problems of long-range development of energy engineering and efficient transformation and utilization of energy, and then sets for the corresponding ministries tasks for improving the work in these areas.

Supervision of the implementation of decisions and instructions concerning efficient utilization of energy is the responsibility of the energy inspection which is part of the Central Energy Commission. In 1980, two-thirds of all combines under central jurisdiction underwent the first comprehensive inspection of their activity in the area of energy engineering. Regular inspections follow with an interval of 2-5 years, depending on the importance

of the combines and enterprises for energy management. If serious violations are found orders are issued concerning eliminating them, and fines are either envisioned or imposed. Special energy inspectors or head energy engineers work in the ministries and at the combines and enterprises. A new policy has been introduced which makes it possible to enlist specialists of the national economy along with the staff workers of the energy inspection.

Working in close cooperation with the Ministry of the Coal and Energy Industry is a working group for efficient utilization of energy under the GDR Council of Ministers. Its leader is under the jurisdiction of the Central Energy Commission. This group is responsible for the development of concepts in the development of efficient utilization of energy and measures for influencing the main processes of expenditure of energy, the preparation of economic and legal provisions, cooperation with press agencies, and so forth. Under the leadership of the Ministry of the Coal and Energy Industry (for liquid energy products--in cooperation with the minister of the chemical industry) a comprehensive energy balance is being developed, state limits on energy products are being distributed, and necessary permission is being granted for the use of energy products during the assimilation of capital investments and reconstruction.

The Institute of Energy and the Central Administration for Efficient Utilization of Energy are developing drafts of a comprehensive energy balance for the country and, in cooperation with district administrations, are exerting influence on energy planning that is carried out by the ministries and combines, evaluating the energy parts of the plans, and coordinating and developing international tasks for efficient expenditure of energy. The district administrations of the energy combines participate in efficiency work, whose results are subsequently applied at many other enterprises, and in the development of territorially expedient decisions for heat supply, including the utilization of discharged heat and heat pumps.

Methods of planning on which the five-year plan for 1981-1984 are based contribute to further raising the quality level of energy planning. These include the creation of a central state stockpile in the area of efficient utilization of energy, which is envisioned by the state plan for science and technology and also the plan for capital investments and work for improvement of efficiency, the regulation of balance responsibility for the most important positions in material and technical insurance of efficient utilization of energy and, finally, special planning for discharged energy.

Many combines and enterprises, in keeping with the directive of the Central Energy Commission, with assistance from trade unions, have created energy aktivs. They exert an effective influence on the implementation of the tasks in the national economic plan for greater economy of energy, and, in particular, they contribute to more rapid introduction of efficiency decisions and proposals of innovators and check on the observance and the reduction of state limits.

The GDR Chamber of Technical Equipment conducts a significant amount of work on a planned basis for mobilizing scientific workers and engineering and

technical personnel to conduct multifaceted measures for economizing on energy resources. It helps in solving scientific and technical problems and engages, in particular, in training and improving the skills of operators of small boiler installations.

The GDR Ministry of Science and Technology gives monthly information about the implementation of tasks of state and branch plans for science and technology with a breakdown for the various branches and districts. The course of the fulfillment of the physical indicators for economizing on individual kinds of energy as a result of the achievements of science and technology is generalized in semiannual reports of the GDR Central Statistical Administration.

The experience of industrial enterprises that have changed their boilers and thermal stations over from fuel oil to lignite is of great national economic significance. Although the implementation of such measures requires expenditures on re-equipping the furnaces and reconstructing the boilers, these expenditures are quickly recouped. Recently the plants, shops and brigades have been earmarking concrete assignments for reducing the proportional expenditure of fuel and energy resources.

A well-thought-out system of incentives for enterprises and individual workers contributes to conditions for economizing. Normative acts promptly reflect the changing objective requirements. Practically every year since 1971 the conditions for moral incentives for the winners of the competition for economizing have been revised and augmented. New provisions were recently adopted concerning material incentives for workers for economizing on the most important sources of energy for the national economy. They indicate coefficients of material incentives for economizing on 79 of the most important kinds of raw materials, processed materials and energy. The amounts of the coefficients range from 1.2 to 3. Thus the coefficient of material incentives for economizing on electric energy is 2.5; rock coal--1.3; rock coal coke--1.7; lignite--2; lignite briquettes--2; gas--1.3, and so forth. In keeping with the existing prices for energy, the quantity of the substances that are saved and these coefficients determine the amount of the incentive sums.

Another provision went into effect on 1 December 1981. It establishes the norms for the expenditures of fuel, depending on the kind of machine, and material incentives for economizing on fuel. The material incentive for each liter of fuel that is saved as compared to the established norms is differentiated depending on the amount of the norm with respect to the normative indicator according to the established catalogue of normatives for the expenditure of fuel. One of the decisive indicators for material incentives is the level of material expenditures per each 100 mark's worth of products.

The Emblem of Quality is awarded to an item only if it corresponds to the best world models not only in terms of consumer qualities and external finishing, but also in terms of its economy, particularly its energy-intensiveness. Each new item should be more productive and more economical in the consumption of energy than the preceding one.

The title "enterprise (or region) that has achieved exemplary indicators in economizing on energy" is awarded for success in the area of energy engineering to combines, enterprises and institutions, and since 1980--to cities and communities. They are entered in the book of honor and receive a monetary bonus. This form of material and moral incentive has been effective. Competition has been extensively developed for the title "Best in the Profession." When determining a winner from a number of enterprises with equal fulfillment of planning indicators one also takes into account the results that have been achieved by the competitor in economical expenditure of raw materials, processed materials and energy. These results directly affect the amount of the earnings.

The GDR does not plan to increase the imports of coal, petroleum and gas during this decade. In order to expand the production of energy, about one-third of the capital investments in industry will be used in the energy and fuel sphere. While during the past decade (the 1970's) the economy on energy was provided mainly as a result of structural changes in favor of petroleum and gas, at the present time this is impeded by the return to more extensive utilization of lignite. The GDR is faced with a complicated task of further intensifying efficient utilization of energy.

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CAPITALIST EXPERIENCE IN BUILDING, EQUIPPING 'MINI' METALLURGICAL PLANTS

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 125-132

[Article by A. S. Belorusov, candidate of economic sciences, All-Union Scientific Research Marketing Institute (Moscow): "Equipment of Small Metallurgical Plants"]

[Text] The Basic Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period up to 1990 envisions the construction of small metallurgical plants (mini-plants) in our country. Their construction has been started in various parts of the Soviet Union. Some of the equipment is being purchased from abroad.

Continuing our articles about mini-plants, we offer the reader the article below which discusses foreign experience in this area.

Small metallurgical enterprises began to proliferate in the capitalist world as early as the 1960's. They first appeared in the United States and Italy, and then began to be constructed in other countries, including developing countries. They are located, as a rule, not far from the areas where scrap metal of the necessary quantity and quality is amassed and not far from the consumers of the metal. This makes it possible to avoid large transportation expenditures. The main advantages of mini-plants are low expenditures on construction (25-40 percent less per ton of capacity than plants with a complete metallurgical cycle); brief time periods for startup (from 15-25 months from the beginning of construction); low production cost of products; and simplicity of administration.

The number of them increased sharply in the 1970's. While in 1970 there were 80 of these enterprises with an overall capacity of 8.2 million tons of steel a year, in 1981 there were more than 350 of them. The overall capacity reached 72 million tons, that is, almost 10 percent of the world production of steel was smelted at these plants.

As experience in the construction and operation of mini-plants is acquired, the productivity and economy of the equipment increase, and the capacities of newly constructed enterprises also increase. While at the beginning of the 1970's the capacities of the enterprises ranged from 20,000 to 200,000 tons of steel a year, by the beginning of the 1980's more and more of them had production capacities of about 500,000 tons, and some of them--up to 1 million tons and more. This brings the mini-plants close to the enterprises with a complete metallurgical cycle in terms of their technical and economic indicators. But still a typical set of equipment for a mini-plant is considered to be: a 40-80 ton electric arc furnace with a transformer with a capacity of 20-60 kilovoltamperes per ton, 2-6 channel machines for continuous smelting of billets (MNLZ) for producing 300,000-600,000 tons of steel billets a year and a small continuous automated machine tool with a speed of rolling of up to 80 meters per second. The number of employees ranges from 100, working on three shifts (at an enterprise with a capacity of 100,000 tons of billets a year) to 700 (at plants with a productivity of 500,000 tons of billets).

Equipment for mini-plants is delivered by firms that specialize in metallurgical machine building. The rapid growth of construction of small metallurgical enterprises has led to the appearance of companies which have begun mainly to design and produce equipment for mini-plants. They provide deliveries under various commercial conditions, including the so-called "package construction", whereby the supplier takes on the responsibility of performing all services, work and deliveries of equipment and materials necessary for putting the plant into operation. Enterprises were previously constructed under these conditions in developing countries, but now this is also the case in industrially developed ones. This is determined by the complication of sets of equipment and the introduction of continuous technological processes.

Among the well-known firms that specialize in designing and delivering equipment for mini-plants is the Italian company "Danieli." During 1976-1981 alone it increased the volume of production in monetary terms from 8 to 14 billion lire. The number of personnel increased from 466 to 1,600.

In order to function successfully on the market for equipment for mini-plants, a daughter firm was formed, Danieli Engineering, which does technical designs for complete metallurgical plants, designing of MNLZ rolling mills and purification installations. The latter are in great demand because of the more rigid norms for environmental protection in industrial countries. In order to manufacture purification installations another firm was formed--Daneko Danieli Ekologia. Danieli Engineering also realizes the designs it has developed, teaches the client's personnel to operate and service the equipment that is delivered, and provides technical supervision over the achievement of the level of planned capacity by the enterprises that have been constructed.

Certain firms of capitalist countries are arranging their own organizational structure according to the principle "I produce where I sell." Thus the Danieli group has formed branches in countries that are potential purchasers of its equipment and services (the United States, Brazil, Colombia, Singapore, England, and on the African continent). Before 1980 it delivered to

clients in various countries of the world more than 400 MNLZ's, 900 rolling mills and 1,600 lines of cutting steel strips. The company takes advantage of the experience and developments of world known enterprises of metallurgical machine building and fills out its deliveries with items from these enterprises. This pertains especially to MBLZ installations for which Danieli has the license of the Swiss firm Konkast.

The Danieli company designs and manufactures its own rolling mills. But in a number of cases the set of equipment for the mini-plants includes mills that are manufactured by other firms in keeping with the wishes of the clients. Rolling mills are produced by the West German company SMS, in whose activity the Danieli group invests 20 percent of its capital.

Another well-known designer and supplier of equipment for mini-plants in the capitalist world is the West German group Korf which has grown during the past ten years from the small private enterprise of the metallurgical engineer Willi Korf into a transnational corporation. It has designed more electric arc furnaces for mini-plants than any other specialized firm. Just one daughter company, Korf and Fuchs (United States) has constructed and modernized about 200 electric arc furnaces in the United States, Canada, Mexico, Argentina, Brazil, Spain, the FRG, Great Britain, France and other countries. The design advantages of the Korf products includes a system of energy control of the electric steel smelting process. Water-cooled copper panels hold up under more than 7,000 smeltings. The installation of oxygen-fuel jets considerably reduces the expenditure of electric energy, from 535 kilowatts per hour to 355 kilowatts per hour, per ton of product as well as the length of smelting. For this purpose the charges are heated before smelting in loading baskets or in individual chambers with discharged burning gases, which were previously discharged into the atmosphere. The duration of smelting has been reduced from 3 hours to 70-80 minutes.

Usually Korf organizes the training of personnel of the purchasers with operating furnaces. They study the most efficient variants of the location of the equipment in the shop, the steel smelting process in the various stages of smelting, and the optimal composition and quality of the charges.

Among the more modern orders one should include the design for a mini-plant of the company Iron and Steel of Trinidad and Tobago which was realized by the firm Korf Technologies in conjunction with the Canadian engineering company Hatch Associates. This plant, with a capacity of 700,000 tons of steel a year, is quite unusual for this type of enterprise. The island state in the Caribbean Sea of Trinidad and Tobago has only supplies of petroleum and natural gas. The calculations of the designers of Korf Technologies and Hatch Associates showed that mini-plants will be profitable even with importing iron ore from other countries and shipping some of the products from the plant to neighboring countries (metal pellets and small pieces of rolled metal). Two installations for direct restoration of iron, in which natural gas is used as a restorer, are delivered by the American company Midrex Corp., a daughter enterprise of the Korf group. One of these installations with a capacity of 420,000 tons of metal products a year was put into operation in August 1980. In December of the same year the first steel was produced by the

electric smelting shop, which includes two 90-ton electric arc furnaces manufactured by the Manesmann-Demag Company (FRG). The smelting lasts two hours. The liquid steel goes from the furnace into two 4-channel MNLZ's of the curvilinear type which were constructed by the Japanese firm Sumitomo heavy industries according to a design of the Konkast company.

Smelted billets with rectangular cross-sections with sides from 100 to 150 millimeters at a temperature of 1,100 degrees centigrade are put into a bar-wire mill which was designed by the West German company SMS and manufactured by the American firm Morgan Construction. Its productivity is 600,000 tons of rolled metal a year.

The cost of an entire enterprise of the firm Iron and Steel of Trinidad and Tobago with a capacity of the first section of 500,000 tons of steel a year is 385 million dollars (in 1980 prices), that is, 550 dollars per ton of installed capacity, which is significantly less than other indicators.

Of the more modern mini-plants in industrial countries, is the enterprise of the American company Bayou Steel in Laplace in the state of Louisiana near the port of New Orleans, which began to produce products at the end of 1981. The features of this enterprise include providing scrap metal from distant sources (using inexpensive water transportation), and it intends to sell products throughout the entire territory of the United States and even ship them abroad. Two 65-ton electric arc furnaces have been manufactured by the company Fjostalpine according to a plan of the Krupp firm (FRG). In general, of the West German firms the main manufacturers of electric smelting furnaces are Manesmann-Demag, Guterhoffnungshütte Sterkade and Krupp, the greatest demand at the beginning of 1980 was for products of the latter. Among other factors, the extensively advertised operation of the 100-ton electric arc furnace in the plant in the city of Singen contributed to its success. It has the highest operational indicators in the world for such furnaces. Computers establish the optimal conditions for feeding in charge materials and alloy supplements, and therefore one furnace like this provides for an annual production of about 600,000 tons of steel. The time of smelting is 90 minutes. Both furnaces were put into operation in 1981. From the furnace the liquid metal goes into two identical 4-channel MNLZ's of the curvilinear type, manufactured by the company Fjostalpine. The smelted billets go to a 15-cell continuous small machine tool manufactured by the Danieli group.

Japanese companies have worked most actively to construct mini-plants in developing countries. For example, at the end of the 1970's the design of the Japanese firm Kobi Steel was used to construct a plant in Qatar--Qatar Iron and Steel Co. (QASCO). Its production capacity is 400,000 tons of steel a year. The equipment includes an installation for direct restoration of iron installed by the American firm Midrex Corp. The 70-ton arc electric furnace with a productivity of 416,000 tons a year was installed by the Japanese Niponkoku. The liquid steel goes from the furnace into 70-ton buckets on a 4-channel MNLZ manufactured by the firm Kobi Steel. The billets go into a 20-cell sorting and rolling mill of the Japanese firm Kobi Steel with a productivity of 330,000 tons of rolled metal a year. The cost of the plant at the QASCO firm is estimated at 357 million dollars. Thus one ton of installed capacity costs 890 dollars.

Table. Mini-Plants in Foreign Countries, as of December 1981

| Country (territory) | Number of mini-plants | Annual capacity, thousands of tons | | |
|----------------------------------|--------------------------|------------------------------------|---------|---------|
| | | Overall | Minimum | Maximum |
| Industrially developed countries | | | | |
| Japan | 64 | 22,700 | 92 | 1,200 |
| Italy | 62 | 2,600 | 30 | 500 |
| United States | 59 | 14,700 | 60 | 800 |
| Spain | 25 | 1,700 | 60 | 600 |
| Canada | 7 | 2,400 | 200 | 1,100 |
| Great Britain | 7 | 2,200 | 70 | 1,000 |
| FRG | 6 | 3,400 | 420 | 1,250 |
| UAR | 5 | 1,000 | 50 | 390 |
| Greece | 4 | 1,100 | 200 | 350 |
| Switzerland | 3 | 600 | 100 | 400 |
| France | 3 | 510 | 130 | 200 |
| New Zealand | 2 | 270 | 110 | 160 |
| <hr/> | | | | |
| TOTAL | 250 | 53,700 | 30 | 1,250 |
| Developing countries | | | | |
| Mexico | 14 | 2,900 | 40 | 970 |
| Brazil | 14 | 2,400 | 35 | 550 |
| India | 7 | 500 | 50 | 150 |
| Indonesia | 7 | 500 | 30 | 200 |
| Finland | 7 | 540 | 20 | 250 |
| South Korea | 6 | 4,000 | 45 | 1,100 |
| Argentina | 5 | 900 | 40 | 300 |
| Thailand | 5 | 600 | 45 | 160 |
| Turkey | 4 | 750 | 100 | 750 |
| Colombia | 4 | 230 | 40 | 80 |
| Malaysia | 4 | 300 | 30 | 170 |
| Venezuela | 3 | 800 | 60 | 400 |
| <hr/> | | | | |
| Sum | 97 | 16,590 | 20 | 1,100 |
| <hr/> | | | | |
| TOTAL | 347 | 70,290 | 20 | 1,250 |

Final products of mini-plants are not always limited to high-grade rolled metal. A number of enterprises specialize in rolled sheet metal, particularly for billets for welded pipes. Such billets as pipes of the petroleum assortment are in growing demand.

The purchasers of equipment for mini-plants have a fairly large amount of trouble with technical servicing and providing spare parts. In Canada, for example, a government decree was issued concerning permission to conclude contracts only with those firms supplying equipment which, if necessary, provides spare parts for the imported sets of equipment within 72 hours. It is not surprising that the suppliers of metallurgical equipment devote special attention to continuous organization of deliveries of spare parts and technical servicing. Predictions of the demand for spare parts and programs for their production are usually compiled separately from the main equipment. In order to know which parts wear out most rapidly and are in greatest demand, the firms that produce the equipment maintain constant contacts with the purchasers and subcontractors for spare parts for hydraulic, electrical, electronic and pneumatic equipment. Certain machine building companies hold meetings of the board of administrators each month where they discuss the need to maintain individual kinds of spare parts in the warehouses and include them in the plans for production. A month of storage of spare parts in the warehouses costs the company an average of 2.5-3 percent of their value (40 percent per year). Before dispatching any spare part the computer calculates its price, taking into account the time period of storage at the warehouse and, naturally, the cost of transportation to the consumer. Large machine building companies form special sections whose functions include storing spare parts and providing them for the consumer. These divisions control the peripheral divisions that are sometimes located in other countries and are joined to them by computer communications. Frequently electronics computers are installed in central divisions and display units are located on the periphery. Sometimes divisions are subdivided into those in charge of "slow moving spare parts," that is, those which rarely break down, and those that handle parts which are in greater demand among the consumers.

When analyzing the cost of the construction of mini-plants one should keep in mind the distribution of this cost for planning work, the cost of equipment and the cost of construction. On an average, according to data of the UN commission on the development of industry, from 6 to 10 percent of the cost goes for planning work, 45-55 for equipment, and the rest for construction.

The construction of mini-plants in the capitalist world will continue in the next few years. But because of the crisis in ferrous metallurgy and the weak demand for steel, the rates of their construction, as foreign economists confirm, will decrease. There is an opinion about the expediency of changing over to several small metallurgical enterprises for producing special alloyed steels. In any case a necessary condition for effective operation of mini-plants is to maintain their equipment and technological processes constantly on a modern level.

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NEED TO ATTRACT THOSE WITH HIGHER EDUCATION TO SIBERIA STRESSED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 137-144

[Article by N. A. Denisov, candidate of economic sciences, Central Economics Scientific Research Institute under the RSFSR Gosplan (Moscow): "A Specialist for Siberia. Where Is He Trained?"]

[Text] Siberia is much worse supplied with skilled labor force and specialists with higher education than the western parts of the country are. The result: in industry of Siberia and the Far East certain positions which require specialists with higher educations are filled by technicians and practical workers whose inadequate competence ends up in large losses. Even in the next few years it is necessary for some of the positions held by people without the appropriate education and all positions at new construction projects to be filled by graduates of the higher school.

This problem is being solved partially by the distribution of young specialists. According to our estimate, recently more than 20,000 graduates of VUZ's have annually gone to Siberia from regions of the European part of the USSR, mainly in engineering specialties. At the same time an especially critical situation can be found in the profile branches of the eastern regions since the training of specialists for the more developed and progressive branches of the national economy is concentrated in the European part of the country. This is apparent from comparing the existing and future volumes of production of these branches in Siberia and the employment there of labor force with the training of specialists in the necessary profile in Siberian VUZ's.

In 1980 Siberia provided about 50 percent of the unionwide extraction of petroleum and almost 37 percent of the gas. But the scope of training of petroleum workers and gas extraction workers in the VUZ's of Siberia were modest even on a republic scale (see Table 1). As a result of this, for example, in the leading production association Nizhnevartovskneftegaz graduates of VUZ's of Siberia and the Ural area comprised only about 20 percent of the working specialists. Of the 1,800 specialists in forestry engineering and 1,600 in forestry who are annually graduated by VUZ's of the republic, Siberia trains only about 300 in each of these specialties. At the same time Georgia, which has small-scale procurement and processing of timber as compared

to Siberia, annually graduates about 70 specialists in forestry engineering, Uzbekistan--80 and Estonia--50.

Table 1. Admission for Day Training in Specialty of Petroleum and Gas Extraction in 1979

| Specialties | VUZ's of RSFSR | VUZ's of Siberia | Proportion of admissions into VUZ's of Siberia, % |
|--|----------------|------------------|---|
| Technology and comprehensive mechanization of working of petroleum | 420 | 75 | 17.8 |
| Drilling petroleum and gas wells | 633 | 101 | 16.9 |

More than half of the unionwide resources of industrial timber are concentrated in Siberia. While procurements of it in the western regions of the country become more limited each year because of the inadequate quantity, in regions of Siberia these procurements are held back only because of the lack of material and human resources, and also the handling capacities of the transportation.

Siberia and the Far East now provide about one-third of the extraction of coal in the USSR. With the development of the Kansk-Achinsk and Yuzhno-Yakutsk coal basins, the proportion provided by these regions of the unionwide coal extraction is increasing even more. It is generally known that a considerable part of the country's ore is concentrated in the eastern regions. Large contingents of engineering personnel are required to assimilate these but the graduation of engineers by local VUZ's in the group of specialties "Development of Deposits of Minerals" amounts to half the orders for them. And under this five-year plan the graduation of chemical technologists, geologists, construction workers, and specialists for the transportation industry and machine building (including electronic equipment and instrument building) in the eastern regions will be less than the need for them. True, the shortage of geologists and construction workers is compensated for to a certain degree by the large scale of training of technicians.

The inadequate supply of specialists in raw material branches for the eastern regions and the expected increased need for them and also those in specialties of transportation and the petrochemical industry lead one to the idea that in the future the training of the specialists of the given profile should be increasingly drawn to the regions where they will be utilized in Siberia and the Far East.

But there are many proponents of maintaining the existing distribution of training of specialists in the foreseeable future. Indeed, the training of specialists for eastern regions in Moscow, Leningrad and other European VUZ centers has a number of advantages. In these cities there is a good material

and technical base for the higher school, highly skilled teachers, and rich experience and traditions in training youths. It is less expensive here than in regions of Siberia and the Far East.

But the existing territorial proportion of the admission of graduate students has many negative aspects. Practice shows that residents of the European part of the country are not inclined to remain in eastern regions. According to existing estimates, during the first three years of work from 30 to 50 percent of the specialists who are sent there leave Siberia. A typical example. The USSR Ministry of the Timber Industry in 1975-1977 sent 162 young specialists to eastern regions from the Moscow and Voronezh timber institutes and the Leningrad timber academy. Only 125 of them arrived at their place of assignment. Of those that arrived only 40 remained after three years of work. The inadequately developed network of evening divisions makes it difficult for people, who are closely involved in production, to continue their education. Selective questionnaires of the population show that residents of these regions would like to have the opportunity to obtain a higher education near to where they work. They regard the lack of this opportunity as a serious shortcoming in the living conditions and it is an important social factor in the migration of people to other regions.

One should also take into account that youth undergo training in higher educational institutions mainly at the age of 17-25 years. During this period young people, on the one hand, adapt more easily and, on the other, create families. Therefore training of youths from eastern regions in VUZ's of the European parts of the country also increases the migration of population from the eastern regions. At the same time further development of the system of the higher school in Siberia and the Far East will contribute to retaining population and developing productive forces. This is convincingly shown by more than 20 years of work experience of the Novosibirsk Akademgorodok and the training institutions related to it.

All this shows that the existing practice of training significant contingents of specialists with higher education in the European part of the country for work in the eastern regions has more negative than positive aspects. Therefore in the future when training personnel for the industry and transportation of these regions one should be oriented to a more considerable degree than now toward local training institutions.

In spite of the energetic efforts made in recent years to provide Siberian regions with highly skilled teachers, the proportion of teachers with a higher education is lower here than the average for the RSFSR. The lowest educational level is that of teachers of primary classes, especially in rural regions (see Table 2).

In our opinion, objective factors lie at the basis of the existing situation as well as certain omissions in the planning of the training of specialists. Suffice it to say that the greatest difficulties in providing teachers is being experienced by the oblast with the highest intellectual potential in the eastern regions--Novosibirsk. At the beginning of 1981 only 4 percent of

the teachers of the primary classes had a higher education* and there were not enough teachers in rural schools.

Table 2. Proportion of Teachers With Higher Education in 1979, %

| | RSFSR | Western Siberia | Eastern Siberia |
|-------------------------|-------|--------------------|--------------------|
| Total | 64.8 | 58.6 | 60.8 |
| Including | | | |
| City | 72.6 | 66.8 | 67.8 |
| Country | 56.9 | 51.8 | 54.1 |
| Teachers of classes 1-3 | | | |
| Total | 16.4 | 5.8 | 8.4 |
| City | 25.6 | 9.0 | 12.8 |
| Country | 8.8 | 3.0 | 4.7 |

The inadequate development of branches providing social and cultural service for the population, which is especially crucial in regions of new construction projects, does not create better living conditions for residents of the eastern regions than for those of the central oblasts. This contributes to the migration of population, especially of those who have not lived here for very long, to the regions of the European part of the country and to the reduction of personnel in the region's production base. Therefore it seems to use that in the future it will be necessary to expand the training of specialists in the nonindustrial sphere in Siberia and the Far East.

The complicated demographical situation in the next ten years will primarily affect the possibilities of expanding the contingent of students in the system of the higher school. The reduction of the contingent of 17-year-old youths will be especially significant under the Eleventh Five-Year Plan. Nonetheless under this five-year plan the admissions into higher educational institutions will be practically the same both in the country as a whole and in the RSFSR. The reduction of the number of potential graduate students in the eastern regions will not be as significant as in the majority of other regions of the country. Therefore there is not only a need, but also a possibility, even under the current five-year plan, of increasing the number of students in VUZ's located here. Greater opportunities of this will be opened up under the next five-year plan.

Expansion of training of specialists with a higher education in Siberia is impeded by the condition of the material and technical base of the VUZ's and the inadequate provision of highly skilled teaching personnel. According to data for 1970, in VUZ's of the European part of the country for each student there were 9.15 square meters of overall space in training premises, and in

*Yagodkin, V. N., "Personnel Decide Everything," NARODNOYE OBRAZOVANIYE, No 3, 1981, p 15.

eastern regions of the republic--only 7.7, including 7 square meters in the Far East. Certain VUZ's are located in the buildings of schools and other adapted premises. There were especially low indicators in such promising territories as Krasnoyarskiy Kray (7.2 square meters), Tyumen Oblast (5.9 square meters) and the Yakutsk ASSR (5.7 square meters). In Siberia and the Far East, with their immense territories and small number of VUZ's, the need for dormitories for students is greater. But the provision of these is less than in VUZ's of the European part of the country.

The problem of highly skilled professors and teachers is even more critical. In the RSFSR 40.4 percent of the department heads were doctors of sciences, and in the eastern regions--only 18 percent, including in the Far East--12 percent. Among the teachers in the republic 44.7 had degrees, and in the eastern regions--36.6, including in the Far East--32.3. These circumstances are brought about by the fact that the possibilities of expanding the training of specialists are modest as compared to the needs, especially if this must involve the construction of new VUZ's.

The most effective way of developing the higher school in the eastern regions is to improve and expand the material base of existing VUZ's and assign qualified teachers to them. Of course, in individual cases in rapidly developing regions it is necessary to open new VUZ's or to separate out specialized institutes from existing polytechnical VUZ's. Thus on the basis of the departments of the Tyumen Industrial Institute it is expedient to create a training institution that is oriented toward graduating specialists only for the petroleum, gas and petrochemical industries. In Krasnoyarsk it makes sense to create a specialized construction VUZ on the basis of the construction department of the polytechnical institute. A number of other similar proposals have been substantiated.

At the same time the numerous plans for the creation of new institutes are not justified under existing conditions. They involve the process of many years of construction and arrangement of the training process and require large expenditures per one student and more teachers and service personnel.

Under the Eleventh and Twelfth Five-Year Plans Siberia and the Far East will need to increase capital investments in the expansion and modernization of their VUZ's. With the present scale of capital construction the RSFSR Ministry of VUZ's will need more than five years in order to put the present foundation of training institutions into operation. The ministry now has the possibility of essentially increasing capital investments in strengthening and expanding the training and material base of the VUZ's in Siberia and the Far East. It will be possible to implement the program for the development of the network of higher educational institutions in short periods of time only with funds from the involved ministries.

In order to attract and retain qualified professors and teachers in the eastern regions, it is necessary to create a system of the corresponding benefits, primarily housing. And on the whole this problem, in our opinion, should be resolved within the framework of the overall system of measures directed toward retaining population in the eastern regions.

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INSTITUTES OF HIGHER LEARNING MUST PREPARE STUDENTS FOR NEW TECHNOLOGIES

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 144-149

[Article by V. I. Livshits, candidate of technical sciences, Tomsk Polytechnical Institute: "New Technical Equipment and VUZ Programs"]

[Text] The real situation in mass higher technical education is such that production is outstripping training. This means that in production new technology, equipment, fittings and instruments are appearing and finding their place before this is reflected in the training plans, programs and training aids.

Speaking in the spring of 1980 at the All-Union Conference of VUZ Workers, the president of the USSR Academy of Sciences, academician A. P. Aleksandrov said: "Not so long ago I became familiar with a system created at one of the Tomsk plants for automation of a large machine tool shop with numerical program control and a system of automation of planning. And I understood that this is truly a plant of the future, a prototype of that toward which we must strive."*

This achievement of domestic industry was reflected in the training course of programmers for machine tools with numerical program control in the nearest higher technical educational institution--the Tomsk Polytechnical Institute (TPI)--but, unfortunately, purely unofficially. TPI began training these specialists at the end of the 1960's in response to the demand of industry. They now work at enterprises of Moscow, the Ural area, Central Asia and Siberia. The high level of their training is remarked everywhere. But the graduation of these specialists has still not been legitimized: repeated requests concerning the introduction of this specialty into the course list of the institute and the approval of a different training plan have received no response from the Ministry of VUZ's.

Another example: there was an alarming disparity between the rapidly growing production of means of control electronic equipment and their application. Until recently these means were in extremely short supply, which impeded the

*VESTNIK VYSSHEY SHKOLY, No 4, 1980

automation of production and equipment. Now the electronics industry annually produces tens of thousands of microprocessor sets, mini-computers and so forth. But an extremely unfavorable circumstance was revealed: in the scientific research institutes, design bureaus and plants that design, manufacture and introduce technological transportation, loading and household machines, there are practically no designers that engage in means of flexible automation. Thus a new obstacle arose on the path to automation--the lack of trained personnel.

One must say that the tendency in automated control to replace, figuratively speaking, the horse and buggy with a microprocessor was clear even ten years ago. It would seem that the higher technical schools should have trained in good time specialists capable of utilizing computer equipment for automation of technological, transportation, household and other machines. Perhaps there are no models for training? This is not the case: machine tools with numerical program control are an excellent example of the utilization of computer equipment for automation of equipment. Our country has been producing them for more than 20 years. But what institution for training of specialists is there if even today the higher technical school does not adapt the fundamental disciplines to this technical equipment--mathematics, electronic equipment, production automation and so forth, but continues in the majority of cases to conduct training according to old methods?

This situation is, of course, completely abnormal and the basic reason for it, in our opinion, is that the mechanism for bringing documents for regulating training into line with the modern level of science and technology is rigid and suffers from a great deal of inertia. The VUZ's themselves are forbidden to depart from training plans, even if practice has dictated a critical need for specialists of a new profile.

In this situation the role of "clinical" methods of training increases significantly--production practice, course and certificate projects on assignments from the enterprises, and so forth. But hopes of offsetting the costs of training programs by these methods are rarely justified: the fact that classroom training--lectures, laboratory work and so forth--lags behind the modern level of technical equipment and technology frequently leads to a situation where the students in practice are forced to "stop up the gaps" in their knowledge and there is no time for serious work on engineering tasks.

The many years of attempts on the part of the Ministry of VUZ's to "catch up with" practice show that apparently this task is not within the power of one organization. Obviously one should eliminate excessive centralization and give large regional VUZ's the right to take the pulse of production themselves and to make the necessary changes in the training plans and programs with subsequent approval of them. One can only be surprised that the useful undertakings of the VUZ's themselves that are dictated by the needs of practice do not encounter support in the Ministry of Higher and Secondary Specialized Training Institutions.

But life sets new tasks and the practice of advanced production makes adjustments in any theories and hypotheses. At one time it was thought that as

production is automated workers will raise their educational level and become technicians and engineers, that is, they would "rise" to the level of engineering and technical personnel and take a step toward them. The practice of the introduction, for example, of metal cutting tools with numerical program control produced a quite different picture. It turned out that in order for the automated machine tool to produce the same product as the old machine tool controlled by a highly skilled worker, the engineer needed to include in the control program the professional knowledge of this worker, fusing it with the knowledge of a technologist. In other words, the engineer has to master all the baggage of knowledge of the machine tool worker and keep in step with him. This radically changes the VUZ situation in instilling the occupational skills of the engineer-technologist.

Many traditional ideas are now breaking down in engineering thinking in general. The fact is that during the first third of the 20th century the development of production proceeded along the path of creating so-called small systems. And one of the aspects of the modern scientific and technical revolution is the appearance of technical equipment for large systems (system technology). In particular, automation of production is a changeover from small economic and technical systems to large ones.

The development of small systems relied primarily on detailed analysis and on growing specialization of tasks and methods. The development of large systems, on the contrary, presupposes integration, synthesis, and coordinated consideration of various aspects of the phenomena. Under these conditions there is a greater demand for workers who master the system approach in each area of modern technology--systems technicians.

Systems technicians are called upon to combine the approaches of specialists of various profiles for a combined solution to a complex task. As distinct from specialists who have absorbed details, they deal with the overall problem and the overall evaluation of the results, and in this sense they are workers of a new type--generalizers. They are not administrators themselves, but they prepare decisions for the administration.

The systems technician, as opposed to the specialist (expert), is a worker with a broad profile. He is obligated to be an expert in all areas, but he needs the ability to ask experts and to understand their viewpoint, whether they be theoretical or practical workers.

Thus there are principal differences between generalizers (systems technicians) and specialists (experts). Today we need most of all generalizers who are very familiar with many work methods. We also require specialists who have mastered some particular method but not to perfection.

Higher technical education has responded to this need of production by advancing the concept of "specialist of a broad profile" (note that this combination of words is contradictory from the standpoint of terminology). This concept in principle correctly reflects the growing role of fundamental knowledge in the development of technology and production. But its realization, unfortunately, has frequently been perfunctory and frequently taken

place through administrative pressure. Here one does not take into account, and sometimes forcibly breaks down, the existing methods and forms of developing professional skills that are necessary in engineering activity.

In the training plans with which specialists of a broad profile are trained more hours are devoted to higher mathematics in junior courses and certain other fundamental disciplines have been expanded as a result of a decisive reduction and even an elimination of individual specialized disciplines. A most important criterion of this concept is the level of provision of teachers with university education at higher technical educational institutions (mathematicians, physicists, chemists, mechanical engineers and so forth). The course entitled "automation of production processes," which was proclaimed a general engineering discipline was removed from the load of the profile department and transferred to the general department and is given according to a standard program to everyone without distinction--future geologists, chemists, electric energy engineers, mechanical engineers, welders Naturally, from the standpoint of occupational knowledge, for example, in the area of automation of production in machine building, this program can withstand no criticism.

A clear example of the departure of training from today's level of technology and technical equipment is the teaching in the higher technical educational institution of numerous sections of mathematics. In the overwhelming majority of cases it is offered to future engineers as a simplified and emasculated course in university mathematics which is not related in the slightest to the specific nature of the future specialty. This situation was criticized more than 20 years ago at the first all-union conference of heads of mathematic departments of higher technical educational institutions, in which many outstanding mathematicians and teachers of the country participated. But the situation remains up to the present day. This is explained to a considerable degree by the fact that mathematics departments are formed from graduates of the university for whom it is easiest to teach what they learned, without burdening themselves with studying the specific features of the future specialty of the students. Any criticism of mathematics departments regarding this is now regarded as an undermining of the model of specialists of a broad profile. Therefore the profile departments must increasingly frequently enter the path described by professor G. Balandin as follows: "Recently after heavy debates in the rector's office we undertook to give part of the higher mathematics course ourselves."*

In recent years the "consumers" of young specialists have uneasily noted the drop in the level of their occupational training, their poor mastery of methods of engineering and production-technological activity, and the disparity between higher education and practice. This uneasiness is also persistent on the pages of the central press. There is no doubt that these problems are the result of the deformed, one-sided realization of the model of the specialist of a broad profile in higher technical educational institutions. Because of this the leaders of the Ministry of VUZ's have begun everywhere to explain

that the specialist of a broad profile is primarily a professional and the center of gravity in his training should be in professional training. But it is extremely difficult to stop a fly wheel that was put into motion ten years ago, and the more so to reverse it.

How does one train engineer-systems technicians for various branches today? The Soviet higher school has many years of experience in training engineers with good systems-technical baggage: technologist-mechanical engineers, metallurgists, chemists, food workers and so forth. The technologist, because of the logic of his occupation, provides for finding the most economical path to the final result--high-quality products. In other words, the system approach is implemented in the activity of the technologist.

This approach explains many peculiarities of the activity of the technologist, for example, the fact that the technologist is in the center of production, playing a leading role with respect to departmental specialists and so forth. Apparently this also explains the many years of persistence of technological specialties which have existed for dozens of years and remain necessary to the national economy.

The increased graduation of technologists who have a deep knowledge of their work and have mastered the most modern methods of professional practice will make it possible to satisfy the demands of production for systems technicians more rapidly.

Large reserves are hidden in the "technology" of higher technical education. Their utilization, and not the enlistment of additional resources in the form of staffed units of teachers and a longer training time--this, in our opinion, is the way to improve the training of engineers. In other words, in higher technical education, as in the economy as a whole, it is necessary to change over from the extensive path of development to the intensive one.

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NEED FOR PRACTICAL AS WELL AS THEORETICAL EDUCATION VIEWED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 149-153

[Article by D. V. Ageyev, doctor of technical sciences, professor, Gorkiy Polytechnical Institute imeni A. A. Zhdanov: "Active Lecture Method"]

[Text] How does one train specialists who meet the requirements of modern production, achieve the best assimilation of material, develop the initiative and creativity of the students, and reduce the time period for their adaptation to production? The answer is not new. By the introduction into the training process of active methods of teaching and business games, increasing the role of practice . . . and with the help of the ordinary lecture. To do this it is necessary to strengthen the problem nature of lecture teaching, to select from the immense flow of scientific and technical information the main things that are necessary for the formation of a highly skilled specialist, to direct the attention of the students to the key problems of the specialty, and to constantly revise the content of the training process in keeping with the condition and prospects of science and technology. The possibilities of lectures are far from exhausted.

But in the majority of VUZ's training, unfortunately, is still arranged around the memorization of an immense number of facts which comprise the content of the training discipline. And the degree of preparation of the students is determined by their capability of memorizing facts and explaining them. In other words, a typical feature of training is cramming.

Having received the knowledge, frequently in "masticated" form, from the head of the lecture, the students do not have an adequate mastery of the habits of independent study of subjects in books and journals. There is no feedback between the lecturer and the audience, which deprives him of the possibility of promptly adjusting his lectures and working in a differentiated way with the students. The effectiveness of this lecture training is not great, which has been discussed in the mass and specialized press.

But in the age of the scientific and technical revolution the customary lecture system to a certain degree impedes the improvement of the quality of the training of specialists. Therefore it is necessary in our opinion, not to improve, but to radically change it, having proclaimed a new goal of professional education.*

*The new goals of professional training have been discussed repeatedly in our journal. See: L. B. Naumov, "Professional Education--Revolutionary Changes," EKO, No 5, 1979; No 5, 1981.

The new goal should consist, in the first place, in teaching the student to learn--to utilize specialized literature effectively (as distinct from "memorizing knowledge that is obtained") and in the second place, to teach him to confidently apply knowledge when solving problems in his specialty (as distinct from "understanding the material that is studied").

It is necessary, of course, to understand the material that is being studied, but this is only the first and the easiest and most passive stage in mastering the training discipline. The goal of training requires an understanding of the material that is studied, but not a memorization of it. There is an immense distance between understanding theory and being able to apply it in solving problems.

Since it is much more difficult to teach people to confidently apply knowledge than to teach them to repeat it, it is expedient, in my opinion, to use a large part of the lecture time for teaching creative thinking and a smaller part for presenting the latest achievements of the discipline being studied which have still not been reflected in textbooks and training aids. The actual material that makes up the content of almost all of the training program can be studied by the students independently in textbooks and specialized literature.

With this kind of active method of training the lecture takes on a different appearance. The teacher sets tasks for the students and then discusses how to construct deductions in order to solve them. Each lecture ends with a 15-20 minute quiz in which the students are given a problem whose difficulty is calculated for the average student who is working regularly. The teacher and his assistants, when correcting the work, give the appropriate grades. If the student has failed the quiz without a good reason he receives a zero. His success throughout the entire semester (before the examination) will depend on these grades.

The quizzes at the end of the lecture will provide a great deal:

they will motivate the student to attend lectures regularly since zeros essentially reduce the average points for the semester;

they create incentives to study the recommended literature regularly (without it they cannot solve the problems) and to train themselves in solving problems that require logical thinking and intuition. It is not enough to passively follow the ideas of the lecturer;

knowing that the methods of thinking presented by the teacher will be required right at the end of the lecture, the student is more interested and listens to the lecture attentively;

regular feedback is created between the lecturer and the class. The teacher sees which methods of creative thinking are more difficult to assimilate and which require special attention in subsequent lectures and in selecting quizzes;

from the grades on the quizzes the teacher can judge the current success of the student, his abilities, discipline, attentiveness, conscientiousness and other qualities. He actually becomes an educator, which is not the case with the traditional system when before the examination the lecturer has no idea of what kind of student one person or another is.

The examination is also the same kind of control work, during which each student must solve not one, but two or three problems in 1.5-2 hours. The overall preparedness of a student in a given discipline is characterized by the resulting point which takes into account not only the examination grade, but also the average number of points for the semester. Consequently, the examination ceases to be the only criterion of success.

It is typical that during the quizzes and the examination the students can use lecture notes and any other literature. They are not required to have memorized various facts of the discipline being studied, but to be able to extract information rapidly enough from the context or from a book and apply the necessary information in order to solve the problem.

One should emphasize that we are speaking about increasing the effectiveness of ordinary lecture teaching which is done by professors and docents. If the quizzes included only practical knowledge and were given by assistants, many of the advantages of lecture teaching which were discussed previously would disappear.

What is necessary in order to introduce an active method of lecture teaching? Since a considerable part of the VUZ lecturers apparently are not trained to teach students creative thinking, it is necessary to compile special problem books for all disciplines. In addition to posing problems, they must consider the solutions in detail, devoting special attention to the deductions. In order to develop these problem books it is sufficient to have a small group of the most talented scientific and pedagogical workers. For a beginning it is enough for the rank-and-file teachers to basically study the problem books and utilize them skillfully.

In order to give the students additional time for independent work, it would be necessary to reduce the number of lectures, say, by one-fourth.

Instructions on norm setting of the training load of the teachers could be augmented with a point that takes into account the time on correcting quizzes. Let us note that this will not require additional financing for the VUZ's since the money saved as a result of reducing the number of lectures and replacing part of the exercises in the groups will more than compensate for expenditures on paying for correcting quizzes.

Since March 1977 the author of this article has been using the active method of lecture teaching of students as an experiment in two engineering disciplines in the department of radioelectronics and technical cybernetics of the Gorkiy Polytechnical Institute imeni A. A. Zhdanov. Since the time of the studies within the VUZ is not reduced, the students in this experiment independently study only half of the program with training aids. They acquire the

other half of the knowledge in lectures. But even with this method time is freed, which makes it possible for the lecturer to give quizzes at the end of each lecture in groups of five, and in the next lecture to discuss with the students the best methods they have found for solving the problems that have been given. Then seminar studies are not conducted in groups and the hours that are freed are used for correcting quizzes.

The results of the experiment surpassed all expectations. The advantages discussed previously were fully manifested. In particular, discipline became excellent, and skipping classes for unworthy reasons decreased many fold, amounting to an average of 1-2 percent. The students regularly read the recommended literature and willingly solve dozens of problems. The examination --and it is given immediately for all students of the academic group--is taken in a calm and confident situation. All students, solving the same problems, are in an equal position. Their examination has ceased to be a lottery. For the first time in the 45 years of his scientific and pedagogical activity, the lecturer has felt himself to be an educator of all students, since now he knows each one of them from the results of the quizzes and has an opportunity of promptly exerting the appropriate influence. But an even more important result consists in that the heavy weight of cramming has been removed from the students and during the course of study they acquire skills of solving real problems, that is, that which they really need after graduating from the VUZ.

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SELECTING, DEVELOPING MANAGERIAL PERSONNEL

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[Article by A. A. Balayev, senior teacher of the Sverdlovsk Branch of the Central Institute for Increasing Qualifications of Managers and Specialists of the USSR Ministry of Heavy Machine Building: "Entering a Position"]

[Text] From a transcript of the conversation in which the plant director, the secretary of the party committee and the chairman of the plant committee participate:

Secretary of the Party Committee: -- So what shall we do about the instrument shop?

Director: -- We shall assign a new chief and let him think about it.

Chairman of the Plant Committee: -- And have you selected the candidate?

Director: -- I have. Sergeyev, a section chief of the machine assembly shop. The shop chief will be persistent and not give up: it is clear that he is a worthwhile fellow.

Secretary: -- He is still very young, only a year at the plant

Director: -- That's okay. He will be able to handle the section and bring up the shop.

Chairman: -- But then a shop like that--is not a gift.

Director: -- And have we started to give "gifts"? In a word, I think that we have agreed.

From a report on the state of affairs in the instrument shop:

For the last two years the shop has hardly kept up with the production plan. The workers of the main occupation frequently have to work overtime, two shifts in a row, and they work on their days off. It has become customary that in the third ten-day period of each month the deputy director of the

plant for production sits down at the desk of the shop chief and with his authority "pushes through" the plan.

There is a large amount of labor turnover in the shop, the average annual changeover in the collective is 35-40 percent. About one-third of the workers are graduates of the GPTU.

Cases of violations of labor discipline have become more frequent: tardiness, absence, arrival at work while intoxicated, impoliteness of the masters, and theft of personal items in the day rooms.

From the diary of young specialist Sergeyev:

This morning I was called to the director. The conversation was brief: he offered me a vacant position of head of the instrument shop. The director said: "The management considers you a capable and growing specialist." They gave me one day to think about it. Well, what to do. "Take a chance Kol'ka"--Well, perhaps? . . .

From a conversation between the plant director and Sergeyev:

Director: -- I will tell you directly that you have not been given one of the best shops: the equipment is obsolete, there is not enough production area, the plan is increasing, good specialists do not remain, and the collective is out of hand. It is necessary to begin with discipline. Tighten the screws and it will be alright. I shall help in everything else. And remember: the plan at any price!

A year passed

From an order from the plant:

On the basis of what is presented above it was decided to remove Comrade Sergeyev from the position of chief of the instrument shop and transfer him as senior engineer to the division for scientific organization of labor.

From a transcript of the conversation of the plant director, the secretary of the party committee and the chairman of the plant committee:

Secretary of the Party Committee: -- And so what shall we do with the instrument shop?

Considerations Regarding . . .

The circle is closed. The enterprise did not acquire an intelligent manager and for a certain amount of time it lost a good specialist. A person who has been hurt because of being "released from a position" does not quickly regain his balance and readiness for productive work in another place.

But could it have been different? Undoubtedly it could have if the personnel policy of the plant administration had been based on a clear-cut program for

the forthcoming five-year plan for the selection, training and introduction of workers and specialists into management positions.

Have you ever heard of a sanitation engineer being promoted to a surgeon because of his conscientious attitude toward his duties? This is understandable. Every profession requires professional training.

Unfortunately, the profession of the manager frequently bypasses this golden rule. In some cases it is enough for a person to be a good specialist, a nice fellow and a respected member of the collective for the doors of the office to open up to him.

At one of the enterprises in Tomsk the manager of the planning division went on pension. After festive farewells they began to select a replacement. And they "selected" one. For the position of chief they appointed the quick, energetic, ubiquitous deputy chief of the garage. Alas, the end, as in our situation, was bitter: it was necessary to "relieve the man from the position"--he turned out to be out of place. But yet the plant management had plenty of time (one does not go on a pension "suddenly") in order to select and train a worthy replacement thoughtfully and without hurrying.

Duty and Position

"Position" and "duty"--as everyone knows--are words from the same root. There is not and cannot be a real party and soviet worker who does not unwaiveringly fulfill his duty or who is not able to firmly combine word and deed. Entering a position invariably means taking on, in addition to the corresponding job responsibilities, duties to the party, the people and the specific collective.

Unfortunately, in the practice of administration one sometimes encounters manifestations of a different attitude toward duty and position. The danger of this unnatural division threatens primarily young and beginning managers. At first the attraction to their position and their new selves inevitably leads to a separation from the collection, to administrative arrogance and to forgetting about their duty.

At one of the Omsk enterprises, working in the head technologist's division was a talented engineer, the heart of the collective, an instigator and initiator of scientific and technical discussions, sports tournaments and collective undertakings. And suddenly he was appointed head engineer. Understandably, there were contradictory emotions in the collective, they were happy for their colleague, they were experiencing the forthcoming separation, they wished him success and they envied him a little bit. Only one quarter passed. "It is as if it were a different person!"--his former co-workers said with dismay and confusion. He became dry and cutting in conversation. Imperious tones appeared in his voice. At first his subordinates were perplexed and then some shut themselves off, others became embittered, and still others began simply to leave.

The heady ascent, the unexpected and unprepared for advancement to one of the highest levels of the plant hierarchy of administration turned into a disaster for the enterprise, the collective and for the individual.

The manager is the creator of his own authority. A confirmation of this is the example of O. Ye. Yeremenko, the director of the Omsk instrument building plant imeni Kozitskiy. At a plant scientific and practical conference devoted to social problems of administration he emphasized: "Today administrative and economic methods of control do not guarantee success to the manager if his arsenal does not include means of controlling people, if in arranging interrelations he does not take into account the "human factor" and does not take advantage of the knowledge and theory of administration, social psychology, job ethics and pedagogy." Confirming these words, Yeremenko teaches himself administration, teaches his deputies, plays through with middle level managers the plan-schema of business contacts, holds "days of the master," maintains close contact with scientists, and is creating a plant school of administration.

Where to Find Managers?

Each enterprise has its own method of solving this problem. One director will entice "Varangians," another quickly selects people from his own collective and still others, like, for example, the general director of the Omsk-shina production association, hero of socialist labor P. V. Buderkin, patiently, painstakingly and promptly brings them into the plant "reserve for advancement." The third way is undoubtedly the most reliable and effective. But it cannot always guarantee 100-percent success in the personnel policy. But if people enter the reserve who are not capable of complicated, dynamic organizational activity?

The personnel policy of the enterprise should be systematized and perfected. For example, the Magnitogorsk metallurgical plant imeni V. I. Lenin has developed a "model for the advancement of management personnel." It is based on the prospects for the development of the structure of the combine's administration, the staff list and the dynamics of the growth of the demand for managers in line and functional administration. This model makes it possible to plan with sufficient precision the quantitative and qualitative structure of the reserve for advancement for each year of the five-year plan.

Many enterprises of the country have developed "models of managers" with which the personnel services obtain an objective description-evaluation of the candidates for the reserve for advancement. These models give a description of the moral-political, professional-business and psychological requirements for a specific position. The "model of the manager" amounts to a minimum amount of error when selecting the candidates.

At the present time not unsuccessful attempts are being undertaken to develop a model of the personal business career for the worker who has been enlisted in the reserve for advancement. This model is especially necessary for young specialists. It will create in the new person a feeling of the future and confidence, it will remove the problem of searching for "more interesting work" or "work in his specialty," and it will stimulate interest in self-education and improvement of skills.

Finally, this system ends with psychological-pedagogical training for entering the position and the procedure for "introduction into the position."

Entering the Position

"I came to the Sverdlovsk plant for industrial rubber items in 1971 after completing the Siberian Technological Institute. I began work as a shift master, after two months I was appointed technologist, and after three-- senior technologist. Within 14 months I became deputy chief of the shop and within another year and a half was appointed chief of the preparation shop. But, unfortunately, within a month I was in the hospital. Diagnosis: nervous exhaustion. Now I work in the design bureau" (From the notes of a young specialist, 1977).

Five positions in three years. An average of about 7 months in each. Where does one find time to become accustomed to the role of manager and prepare to assume the position, when the time between some of the appointments was only 2-3 months!

Yet entering a position is one of the responsible aspects of the life of the labor collective. The appearance of a new manager is always an event, primarily for his subordinates. As a rule, this act is frequently followed by essential changes in the customary arrangement of labor processes and in daily life. It is also an event for the manager himself, because he not only acquires power and the right to control, to encourage success and punish bad work, but he is also on the threshold of a new and still unknown world of human destinies, strivings, tastes, wishes, needs and so forth. Entry into a new collective causes maximum tension of the psyche, activates mental activity and sharpens perception. In a word, entering a position is a landmark in a person's biography.

Several years ago I was witness to what one might call a unique situation. In the day room of one of the shops of the Omsk radio plant imeni A. S. Popov the entire collective had gathered at a meeting with the new chief. As the secretary of the shop's party bureau later recognized, in his recollection it had been a long time since there had been a case when all the people came to the day room without repeated requests.

The speech of the new shop chief (self-introduction) lasted about 20 minutes. In this energetic speech he presented his "production biography" and his attitude toward the problems and the tasks facing the shop's collective. He knew the shop thoroughly. He was able to discuss the daily work, the customary production environment and the labor process, the people, their wishes and interests and the future with a profound knowledge of the matter and also with exemplary, I would say literary, language. It was as if he led the collective from the parade field into their own production which was familiar to everyone. And the collective supported all of his undertakings. Less than a year later the shop was one of the leading ones in the plant. And all of this began with the assumption of the position--with the "king's speech" of the new manager.

Here is what one of the people who were promoted has to say:

"Just before meeting the collective I determined for myself the positions I would maintain in the first meeting:

"not to criticize the former manager and not to draw attention to shortcomings. This produces nothing but despondency and embarrassment about re-experiencing the past;

"not to threaten violators and slipshod workers with punishment, they will only shut themselves off and become negative, and it is important for me to instill in them a desire to become better;

"not to emphasize the positive or negative role of one group of workers or another, this will not contribute to unity;

"to remind the collective that the shop was once one of the leading ones. This excursion into the pleasant past should motivate each worker to work actively and instill a desire to restore former glory;

"'to draw' the desired model of our future shop and ways of achieving this model. Of course this should not be a promise of a golden future, but a completely realistic program which includes the real possibilities and reserves of the collective. For people do not believe in the most modest descriptions of the future if the movement toward this will require nonexistent labor and material-technical resources;

"and, finally, to rely on the maximum labor and social activity of each worker, even the ones who have violated the rules in the past." And this is how the engineer-chemist of the Omsknefteorgsintez association, G. M. Belov, envisions his first working day in the position of shop chief: "I shall begin the first morning of work by making the rounds. It is important for me to see the eyes of the people, to feel the rhythm of the labor life of the shop, to sense the atmosphere of the interactions among people, with one another and with the technical equipment, to see the environment, to grasp everything immediately as a whole, without looking at details if you wish, with a 'bird's eye view.' The goal of my first working day is not to allow mistakes in judgments, evaluations or questions. I would rather see a veteran manager make a mistake than a new person. Such is the psychology of people. They have become used to the veteran. They know what he can do and what he cannot do and, consequently, they do not require the impossible. They expect that the new person make no mistakes. And they are frequently surprised when he cannot do something, is generally unable to do something or does not know something. In a word, the first day is for becoming familiar with the people, being cautious, and instilling in the people confidence and security about tomorrow."

One can argue and disagree with the positions described in our examples, but one thing remains obvious: entering a position is an art and a science at the same time. Training and preparation to enter a position should be included among the essential tasks of branch training centers, the personnel service and party organizations of enterprises.

Fairly intensive scientific research, experimental and training-pedagogical work is already being done in this area. Models of managers, systems of criteria for evaluating a candidate for a position, tests for occupational selection and other instruments for optimizing personnel work are being developed.

At an international conference of scientists and specialists of the CEMA countries in 1979 a group of Soviet researchers (Yu. Arutyunov, S. Yegorov, S. Kolesnichenko and Yu. Selishchev) presented a business game called "appointment." It reproduced the activity of the higher administrative level that participates in the decision concerning the selection and appointment of a candidate to a management position. The developers of the business game proposed an effective method of evaluating the quality of the candidate for a management position.

The Sverdlovsk branch of the Central Institute for Increasing Qualifications of Managers and Specialists of the USSR Ministry of Heavy Machine Building uses the comprehensive business game "entry into a position." From my observations, active training makes it possible to prepare a person more effectively for future management activity. And the higher and more responsible the position, the more careful should be the preparation and training of the candidate for the art of entering it and work in the management post.

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UNDERUTILIZATION OF METALLURGICAL CAPACITY DUE TO SHORTFALLS IN SUPPLY, TRANSPORTATION

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[Article by V. Ya. Medikov, candidate of economic sciences, Siberian Metallurgical Institute (Novokuznetsk): "KMK and Zapsib: Disproportions and Reserves"]

[Text] It frequently turns out that modern production systems with much better working conditions and with significantly less discharges of dust, gas and so forth into the environment, are essentially unutilized, and systems that are functioning under the worst conditions operate at the limit of their capacities and are on the verge of being worn out. Still the results of the operation of production systems can be essentially improved as a result of fuller utilization of those that are operating most efficiently.

Let us show a possible approach to solving this problem with the example of the Kuznetsk Metallurgical Combine (KMK) and the Western Siberian Metallurgical Plant (ZSMZ). In Novokuznetsk, where they are located, the ZSMZ is the youngest enterprise in the branch. It was constructed outside the city, taking into account the wind rose. And the KMK, created in the first five-year plan, has already celebrated its 50th anniversary. It is located right in the city and influences the conditions of its water and air basin. The situation is exacerbated by the fact that the city is located in a hollow. As a result, in Novokuznetsk it is necessary to take special measures to improve the environment.

Because of the disproportions in the production capacities of individual sections, interruptions in the supply of raw material and means of transportation, the unsatisfactory technical condition of the sets of equipment and the inadequate level of training and skills of personnel, labor discipline and so forth, the production capacities of both the KMK and the ZSMZ are not fully utilized. From the ecological, social and economic standpoint it would be much more effective to take full advantage of the modern equipment at the ZSMZ by reducing the load on obsolete machines and sets of equipment at the KMK. Let us show this with the example of the main industries.

The blast furnaces at the KMK are serviced by the Abagur sinter factory which consists of two shops, and the Mundybash. The ZSMZ has its own factory with modern equipment for the blast furnaces. At all of these factories, because of the shortage of raw material, the production capacities are poorly utilized, especially at the ZSMZ sinter factory. Therefore when determining the optimal coefficients for loading each shop it is necessary to proceed from the idea that the total volume and variety of incoming raw material are constant, and one can only redistribute this raw material among the shops in order to increase the economic effectiveness and improve working conditions and the environment.

When redistributing the load of the shops it is necessary to find out which of them is operating better from the economic standpoint. This is determined in terms of the minimum conventional-variable expenditures (UPR) per one ton of sinter. The latter are calculated under the condition that the shops are operating under equal conditions: the same assortment, quality and composition of the charges, prices of raw material and so forth. Methods have been developed for making these calculations. The criterion of the UPR is obtained by subtracting from these expenditures the conventional permanent expenditures and capital investments, multiplied by the normative coefficient of the effectiveness of capital investments. This is related to the fact that for all of the variants that are considered the volume of production in the system is constant, and consequently, these amounts should also be constant and one can leave them out of the calculations. If one considers the sinter factories that are located long distances away from one another, they criterion must also take into account the change in expenditures on transportation of raw material and prepared sinter. The shop with the least UPR must be loaded more fully.

The calculations made according to these methods under the conditions of the year that was investigated showed that both the planned and the actual volumes of production of the entire system (four shops) can be obtained without utilizing the sinter machines of shop No 2 of the Abagur sinter factory. The annual economic effect will then be 5.85 million rubles, and more than 1,000 additional workers will be released, and they could be used both in the factory and in other industries of the KMK where there is a shortage of about 2,000 workers.

Similar calculations were made for blast furnace production. They showed that it would be much more effective ecologically, socially and economically to obtain the same volume of iron with fuller loading of the modern blast furnaces of the ZSMZ as a result of reducing the load on the blast furnaces of the KMK. And if one takes into account that up to this point up to 7,000 tons of liquid iron a year are delivered from the KMK to the ZSMZ, because of which there is a considerable increase in the production cost of one ton of steel that is produced, the introduction of the proposed variant for loading the furnaces will make it possible to reduce additional outlays and to reduce production costs. Moreover, locomotives and buckets of the mixer type will be released, the load on the railroad will be reduced, and some of the workers can be transferred to other productions.

Let us consider the possibilities of coordinating the work of the oxygen converter production of the ZSMZ and the Marten production of the KMK. The quality of the converter steel is practically no different from the quality of the steel produced in Martens. The technical and economic indicators and the working conditions in the oxygen converter production are considerably better than with Marten production. But the Marten furnaces, as a rule, are utilized fully while the converters have a significant reserve. In order to utilize this, it is necessary to transfer liquid iron from the KMK since the blast furnaces of the ZSMZ do not provide for the necessary increase in the volume of steel production. But this presents special difficulties since no technology has been developed for transferring this iron. With an imitation model that describes the work of the system "blast furnaces--installation for pouring iron--iron shipping buckets--locomotives--section for transporting iron--division for resmelting iron--converters" it was shown that it is possible to increase these shipments. This way one can eliminate 6-7 Marten furnaces, as a result of which there will be considerable improvement in working conditions and the condition of the water and air basins of Novokuznetsk.

The realization of the variant of complete utilization of reserves can come across significant difficulties in a number of situations because of the need to coordinate the work not only of the steel smelting shops, but also of the furnace, rolling, transportation and other shops. Therefore the possibility of halting even one Marten furnace as a result of fuller utilization of the reserve time of converters should not be lost.

In rolling production there are also significant reserves of production capacities. They can be utilized by increasing the load on effectively operating mills and reducing it on obsolete mills where working conditions are poor and effectiveness is low.

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NEED TO IMPROVE TRAINING, MOTIVATION OF ENGINEERS

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 166-169

[Article by V. I. Rybal'skiy, doctor of technical sciences, professor, Kiev Engineering and Construction Institute: "Claims for Replacement of . . . Engineers"]

[Text] How does one make sure that the national economy receives not poorly trained and poorly motivated engineers, but modern, creatively thinking specialists who are capable of finding optimal decisions and continuously and independently updating their scientific and technical knowledge? In order to clarify this far from simple question, let us analyze the entire process of training the engineer in the technical VUZ--from his entry until the issuance of his diploma.

So much has been written about competitions that one might be able to compile a multivolume book out of the newspaper articles alone. It seems that there is nothing to add to this subsiding, but still turbulent flow of critical analysis and recommendations which still do not make essential changes in the policy for accepting students. But perhaps it is worthwhile to look at the problem from another standpoint: the competitive selection for admission to the VUZ in its present form and volume is generally not necessary! It is known that even good school knowledge of mathematics and physics still does not define the ability of the graduate student to carry out the activity of an engineer-metallurgist or builder. The competitive selection is largely formal in nature and does not preclude cases in which extremely promising graduate students remain outside the doors of the higher schools, and many are accepted to the institute who will never become specialists of the modern level.

It seems to us that it is possible to reduce this danger if the main competition is organized not upon admission (here it is sufficient, taking into account school grades, to hold a conversation or even better--play a special business game), but in the process of training in the VUZ, when there is a real possibility of finding and selecting students who are most capable of becoming good engineers. This continuous competition, involving a regular and significant weeding out of backward students, will sharply increase the motivation of the students to work on their studies, and this means that the quality of the graduates will also improve.

Of course this is possible if the number of those admitted is significantly greater than those graduated, which at first glance seems economically disadvantageous. Actually, from a narrow departmental standpoint the expenditures on training one engineer will increase. But the national economy as a whole will benefit by receiving better trained personnel.

But where will those who have been weeded out of the VUZ in the training process go? You will agree that not everyone will want to go into production after having wasted a year or two. It seems that the solution lies in transforming technical VUZ's and technikums into unified training complexes which give both higher and secondary specialized education.

Naturally, the organization of these complexes is not possible for all engineering specialists. Moreover, there arise many problems related to changing the training plans, increasing the role of production practice and laboratory work, extensively utilizing electronic computers and business games, developing criteria for selecting students for secondary and higher education, and so forth.

Let us discuss some of them in greater detail.

The division of the higher school into two levels will require changes in the training plans. In the first three courses the students should master their own specialty--mainly practical knowledge in an amount sufficient for production activity. In the second stage (beginning with the fourth course) the more capable and prepared students will begin purposive study of the fundamental general scientific and engineering disciplines.

And so the first years of training should not be clogged up with a surplus of profound fundamental knowledge which far from everyone needs: the young specialist who has selected a production career will hardly be able to take advantage of one-tenth of it. Does a brigade leader, master, shift engineer or even a shop chief frequently solve problems in physics and chemistry, use higher mathematics, theoretical mechanics or many other fairly complicated disciplines that require hundreds of hours of training time? Moreover, as a rule, they do not have sufficient knowledge in technology, organization, administration or economics, and they also do not have enough production experience.

From all the remaining disciplines one should select only those sections which are equally necessary to technicians and engineers, postponing the more complicated parts of these courses which are intended only for engineering groups to later years. They will be studied in greater depth, but only by those who actually want to and are capable of assimilating fundamental knowledge.

Under conditions whereby the student will be in competition throughout the training, when inadequate effort, standard thinking and a narrow view will inevitably lead to a reduction or even a loss of the chance to obtain a diploma for higher education, he himself will be drawn to the innovations described in the literature of his selected specialty, and he will not miss a

seminar or a conference. He will not walk, but run to the lectures which give him knowledge, and he will leave a lecture hall where they are simply reading aloud a textbook which can be found in the library. In passing let us note that in many cases this will serve as an objective evaluation of the quality of teaching.

The nature of the lectures in the various disciplines which already have good textbooks should change with time. It would possibly be worthwhile to present only innovations, as it were, "selected chapters," and the student could work on the rest independently. In this case the main task of the teacher is to learn to conduct seminars and discussions on material that has been studied by the students outside the classroom, to develop the ability to critically evaluate one scientific-technical method or recommendation or another, and to form and defend one's own point of view. All this will require a new approach to writing textbooks and training aids and the presentation in them not only of "indisputable truths," but also questionable points, competing viewpoints, and also compulsory recollection of the "loop-holes" which science has had, has and always will have.

To develop criteria for dividing students into groups of engineers and technicians is not a simple task either. Here, obviously, it will be necessary to take into account the inclination for scientific work, critical thinking, the degree of assimilation of the more complicated parts of the basic disciplines, and the results of a series of business games. Incidentally, the experience in conducting business games in VUZ's has shown that they contribute significantly to the development of creative competition among student groups and provide them with the ability to be oriented in changing production situations, to make optimal decisions and to achieve their realization. At the same time the results of the games help to determine "who will be who."

An important role in well-founded assimilation of the knowledge of the engineer and technician should undoubtedly be played by the consumer, that is, those enterprises and planning and design organizations where the young people will go to work. Possibly the knowledge should be assimilated not immediately after completing studies, but after one or two years of training on the job, as is the case in several foreign VUZ's.

Then it would be good for the training complex to indicate on the diploma or on an appendix to it what the graduate is capable of and which specific activity he is recommended for. The consumer should have the right to submit a plan for return of poor-quality "products" and to reject poor specialists. But, of course, this makes sense only if the consumer is interested in having highly skilled specialists and obtaining a significant return from his activity, and not simply filling up the staff. The VUZ should react to the claims that are made--for instance, recall such a specialist and finish his training. And if the relations between the producer and consumer of specialist personnel is arranged on a khozraschet basis, this will make them more capacious and also responsible for orders, training and utilization of technicians and engineers.

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INDUSTRIAL-SCIENTIFIC COOPERATION ILLUSTRATED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 83) pp 169-172

[Article by D. N. Sumichev, head engineer of the plant for smelting machines and automated lines, Siblitmash (Novosibirsk): "Difficult But Useful Contacts"]

[Text] The plant began to produce products 28 years ago, and now it is the largest supplier of heavy smelting equipment and is specialized for the manufacture of large machines for pressure founding, molding machines and automated lines.

The plant always has many problems which are difficult to solve without the participation of scientists. But contacts with them, especially with representatives of academic science, are also not an easy matter. . . . I remember a conversation with one doctor of sciences when the main institutes of the Siberian branch of the USSR Academy of Sciences had just appeared. He listened to me and said: "We are working 100 years into the future and we will not find a common language". . . . Well, in production there are also problems of "centuries." I came to Akademgorodok again with one of them. Two scientific workers stood at the blackboard the entire working day and puzzled over the problem we had presented and finally came to the conclusion that this problem bothers production workers throughout the entire world, but no one has solved it yet and there is no foreseeable solution Very well, thank you for your attention.

The plant managed to find a common language with scientists perhaps for the first time 17 years ago in the Institute of Mining. Our conversation consisted in that people were leaving the smelting shop with vibration disorders and there were not many who wished to replace them. As the head engineer they would not leave me alone and demanded that I think of something. One can call it production luck that I managed to meet Doctor of Technical Sciences N. A. Glushin. He took on this problem, as they say, with both hands, and soon the plant received hammers, ramrods, and other devices for the smelting shop. All of them had a small amount of vibration and the vibration disorder practically disappeared from the enterprise.

Subsequently the Institute of Mining remained our constant business partner. Here is one of the last agreements concluded with the institute in September 1980. The subject is the development of pneumatic instruments for dislodging forms of heavy and shell casting. This is a serious problem which, incidentally, is being resolved in a minimum amount of time: within a year the technical documentation was prepared and they began to manufacture parts: the work will be completed in the first half of 1982, that is, less than two years will have passed from the idea to the introduction.

Another of our partners in the Siberian branch of the USSR Academy of Sciences is the special design bureau for hydro-emulsion equipment which is headed by Professor A. A. Deribas, doctor of technical sciences. The joint project is the introduction of blast welding. There are already two blast chambers in operation at the enterprise. In 1981 4,464 parts passed through them, which made it possible to save a considerable quantity of costly non-ferrous metal. Our task is to expand the application of the progressive technology and to develop a broader list of parts. And this is only one of the points in the agreement for cooperation between the special design bureau for hydro-emulsion technical equipment and the Siblitmash plant.

In keeping with the protocol, this same special design bureau has begun another serious project--the creation of the first section in the plant for reduced-waste technology on the basis of hydro-emulsion stamping. What is this? With the metal cutting equipment we shave off a large quantity of metal, we expend a great deal of energy in vain, and we are tormented by increased labor-intensiveness. And the plant is short 150 machine tool operators. The new section will make it possible to do without metal cutting equipment altogether and to combine operations that are now separate. After the experimental work we will conclude an agreement with the special design bureau for hydro-emulsion technical equipment.

We have also found a common language with scientific workers of the Institute of Catalysis. It has agreed to replace the toxic chromium anhydride in the self-hardening pivots for iron casting. Specialists know how complex this problem is. With modern technology the smelting itself "jumps" out of the form, but the chromium anhydride eats up everything, beginning with the metal. It is dangerous and difficult to work with it.

Specialists of the enterprise frequently meet with representatives of the Siberian branch of the USSR Academy of Sciences; the contacts make it possible for us to present difficult problems better and forces us to think about how they can be solved. Under the Eleventh Five-Year Plan we consider a main problem to be the development and improvement of casting: although our own need for cast iron does not exceed 25 percent of the overall output, the plan for cooperative deliveries for the plants that do not have casting shops has been significantly increased. It will be necessary to reconstruct many sections during operation and it will be necessary to increase the output of casting to 50.4 tons per worker per year as against 41.8 tons in 1980. And every step has its difficulties here. Just take the chopping of castings with air-arc cutting and hammers designed by the Institute of Mining. There was a time when we did not even dream about this method. And today it

is not good enough for us. Now we are asking academic science to give us better technology--chambers where the temperature is 4,000 degrees and higher, where castings weighing up to 60 tons can immediately be cleared of seams and splashes.

We are now speaking about creating casting machines with program control. The plant has its own special design bureau, but we need a good deal of assistance from scientists.

True, such plants as ours have limited financial means. In the column "scientific research work" for 1981 we have only . . . 33,000 rubles. We have long had a unified fund for the development of science and technology. It amounted to 455,000 rubles in 1981. This is not enough either. It is planned to spend more than 10 million rubles on increasing labor productivity, improving product quality and increasing the capacity of the enterprise. Without contacts with scientific institutions it is impossible to carry out the assignments for the Eleventh Five-Year Plan.

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ON SIMPLIFYING APPLICATION OF NET NORMATIVE OUTPUT INDEX

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[Article by N. A. Veduta, corresponding member of the Belorussian SSR Academy of Sciences (Minsk), R. O. Megrabyan, deputy manager of affairs of the Armenian SSR Council of Ministers, and A. Ye. Fateyev, candidate of economic sciences (Moscow): "How to Calculate the Normative Net Output Indicator More Simply"]

[Text] The fact that industry has begun to introduce the indicator of normative net output and norm setting of profit in proportion to the production cost minus direct material expenditures is an important step on the path to improving the evaluation of production activity of associations (enterprises) and constructing wholesale prices. The coordination of normatives of profitability approved for various price lists (groups) of products with the capital output-ratio of products and, even better, with expenditures on reproduction of fixed capital (capital investments) and their effectiveness has made it possible to reflect in wholesale prices precisely enough for practical purposes the average public expenditures both on the products and on their further improvement.

Still one should note that the methodological instructions concerning the policy for developing and applying in planning the indicator of net output (normative), this indicator, although it is regarded as a reflection of newly created value, is calculated for a specific item according to the formula:

$$NPCh = Z_{pr} + Z_{pr}K_z + P_n$$

where Z_{pr} --the basic and additional earnings of production workers with deductions for social security (from the production cost of the items); K_z --the ratio between earnings of personnel and service and administrative of production and the wages of all industrial production personnel at the enterprise; and P_n --normative profit obtained as a result of multiplying the normative of profitability by the production cost of the item without direct material expenditures, but with all indirect material and monetary expenditures.

The latter, as we know, do not create new value. Consequently, to add this normative profit to the wages does not form the "net" output at all: it also includes profit obtained by multiplying indirect material and monetary expenditures by the normative of profitability. It would apparently be more logical to determine the normative profit by multiplying the normative of profitability by the direct and indirect earnings distributed among items of the enterprise (in keeping with methodological instructions) in proportion to direct ones.

But if the distribution of indirect wage expenditures among the items in proportion to direct ones is considered permissible, it should be equally permissible to do this with all the rest of the indirect expenditures, which is usually the case. Then the production cost of the items after subtracting direct material expenditures becomes proportional to the direct wages, and, consequently, the indicator is calculated according to the formula:

$$NChP_s = (S - M) \cdot (1 + N_r)$$

where S--production cost of the item; M--direct material expenditures; N_r --normative of profitability, just as the indicator NChP, calculated according to methodological instructions, can serve one and the same purpose. Both of them with equal success, only in a somewhat different scale of measurement, reflect the result of the internal efforts of the labor collective, eliminate the motivation to increase the material-intensiveness of production, and contribute to an objective evaluation of the activity of the associations and the enterprises.

The indicator $NChP_s$ includes not only profit calculated with indirect material and monetary expenditures, but also these expenditures themselves. Therefore it is even less "net" output (because of the fact that it can be given any other name). But all this is only of limited theoretical significance. On the practical plane it even has some advantage of the indicator of NChP calculated according to methodological instructions.

In the first place, in the indicator of $NChP_s$ one establishes more precisely the expenditures of live labor on the production of each item of the enterprise, since the indirect earnings are thus included in the production cost of the items in terms of several calculation points (along with other indirect expenditures), and not to proportion of the direct earnings as is the case according to the methodological instructions.

In the second place, for calculating the indicator of $NChP_s$ and also for determining the normative profit and, consequently, wholesale prices as well it is quite adequate to have the existing information of the production costs of the item in the calculation section and about the normative of profitability. All the special work prescribed by the methodological instructions for developing and applying the NChP in planning becomes superfluous and there is no longer a need to expend large amounts of labor for carrying out the calculations; extensive introduction of the indicator of $NChP_s$ into the practice of industrial production is considerably easier and faster.

Enterprises of a number of branches have done a large amount of work to prepare for changing over to evaluating the activity of the enterprises in terms of the indicator of NChP, and a large quantity of labor of workers of ministries, associations and enterprises has been expended on calculations of the indicators of NChP themselves. A comparison shows that on an average for the enterprises the volume of output calculated in terms of the indicator of NChP is less than the volume reflected by the indicator of NChP_g. For individual enterprises the deviation of this ratio from the average is quite insignificant. The sum of normative profit for the branch remains the same since in both cases it is determined in terms of the established normative by the production cost of the items minus direct material expenditures.

All this shows that the indicator of NChP can be calculated more conveniently as the production cost of the item minus direct material expenditures plus the normative profit obtained by multiplying the production cost minus direct material expenditures by the normative of profitability, and the normatives of profitability can be differentiated for various kinds of technical equipment, depending on one-time expenditures related to improvement and development of production.

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DESIGN BUREAU HEAD DISCUSSES UPS, DOWNS OF OFFICE RELATIONSHIPS

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[Article by V. Sakharov (Moscow): "Personnel and Character"]

[Text] The author of this article is not a writer and not a journalist, but the manager of one of the design bureaus of the USSR Ministry of Energy and Electrification. While psychologists have previously discussed the interrelations in the production collective on the pages of the journal, this time the editorial staff has given the floor to the production worker himself. The difficulties a young manager encounters, his mistakes and omissions, in spite of the apparent simplicity and obviousness, it seems to us, gives cause for thought.

Here it is, the director's office. Now it is mine. The general director of the association just notified me of this. There is already a nameplate: "V. A. Kravtsov."

I do not even know if I am happier or not

Several years ago I would probably have been happy, but now--I do not know

In the semidarkness of the spacious office I sit at a long extended table and think into memories from which I cannot separate myself

Bonus

This was my division's first birthday.

It seems to me that it was precisely then in the collective, which I had tried to select literally down to the last man that the first little crack appeared, a small "concentrator of tensions."

On that day we were distributing the quarterly bonuses. I called in the head designers and leaders of brigades--the entire guard. Everything went normally until Avdey Maksimovich Gayev, my old friend from a former job, stood

up. I could clearly see that his face and hands were tense, and he was nervously pulling at a notebook.

"I think," he said, "that it is necessary to give additional bonuses to participants in the work for mechanism of the manufacture of joints."

Surprised, everyone looked at Gayev: he had done this work himself with one technician.

"We worked unstintingly, without thinking about our own time," Avdey Maksimovich added and sat down.

"What are the opinions?" I asked.

Everyone turned their eyes away.

"Well, then I will speak," I turned to Gayev. "Indeed, Avdey Maksimovich, you have worked very hard this last month. But this was only because you were slow in the beginning. In the end you did not even meet the planned deadline. Why should you be given a bonus? That is even somehow immodest. My opinion: bonuses should not be given for this kind of work. Are there other opinions?"

"Correct, why . . ." said Volgin, my reliable support.

"If there are no objections, everyone is dismissed."

I remained alone and began to think.

And what was that that Avdey threw out? Doesn't he understand what kind of stupid position he placed himself in? And all because of his defiance of objectivity: he can even say this about himself. And yet he knows very well what kind of a slow and disorganized worker he is. He determines for himself the volume of work, establishes the deadlines himself and then I add another month for him and he still does not meet the deadline. You begin to reproach him and he becomes offended, saying that all you think about is work, that you even work at home. And nothing results: there is no return from plan after plan. And what should I do here? For really he is not a loafer

Barmin and Gayev

On the same day I had another unpleasant conversation.

"Valentin Alekseyevich, I would like to have a talk with you. Just you and me," Barmin looked to the side, nervously wringing his hands.

"Well, courage, Grisha," I encouraged him.

Barmin threw a quick glance at me and again turned his eyes away.

"Well the issue is painfully delicate Well, you know," he waved his hand and began:

"When you hired me you promised that you would take the first opportunity to give me a raise. Remember?"

I knew how much depended on my answer and therefore I was tense for a moment. My first conversation with Barmin arose in my memory. At that time he was still working at the famed scientific research institute where he defended his work. Grigoriy, my former co-worker, complained to me that he would never be given the additional pay for a candidate's degree and that he would gladly change jobs. Then I managed to add a staff unit in the association and a personal salary for Barmin and took him into my department. I remember what he said then: "For this kind of money I would be glad to paint walls!" That was all, there was no more.

"No, Grigoriy Avvakumovich," I answered him firmly, "I did not promise you anything."

"You have forgotten, Valentin Alekseyevich, you have forgotten," Barmin tried to insist, but, meeting my glance, he stopped.

"You understand, Valentin Alekseyevich, that I have five years of scientific service and, according to the provisions, I have the right to an increase."

"Those provisions are in effect only in scientific research organizations," I replied to him, "and we have a design bureau."

"Yes, yes, of course," Barmin agreed, "but this can also be done in a design bureau."

"It can be, but it would be the ordinary personal increment which you are receiving already."

"Yes, but still you have the right to add more"

I flared up, leaning way back in my chair, then I restrained myself and said, drawing out my words, leaving time to think:

"We have the right, but still you know what our wage fund is like. And then think how other people would look at this increment. You receive more than anybody else in the division, including the chief. Would that be fair?"

"Well, people are always envious of other people's money . . ." Barmin mumbled.

That conversation left me with a bad taste in my mouth. In the first place, I did not say what I wanted to say. In the second place, I felt that Grigoriy did not understand my position: how can one not give a raise to one's friend if it is possible? The fact that he does not deserve a raise does not interest him. Moreover, he is probably convinced that he deserves it.

But he is not a particularly good designer, he does not wish to work with the group, and tries to do everything alone. And can a good head designer really work alone? . . .

Oh, money! Here Avdey was offended that he was not given a bonus. One wonders whether this is more conceit or greed. I remember that in his old job he also grabbed for every ruble. But what if . . . I picked up the telephone.

"Planning? Galina Pavlovna, I have a big favor to ask of you. Has the management already approved the list of bonuses? I need to add a five for one comrade. If there is no money take it from me. All right: take the five from me and give it to Gayev. Thank you, Galina Pavlova."

It will be interesting to see whether Avdey refuses the five or not. For he will probably know where this "addition" came from . . .

My thoughts were interrupted by the telephone: the boss wanted to see me.

In the Director's Office

Pavel Pavlovich Simov is a tall, dark-haired man with a pleasant, but somewhat feminine face. He got up to meet me and shook my hand. Then he sat down and looked at me for a long time. There was a little smile on his lips. The director frequently asks to see me without a specific reason, simply to chat. I try to use these visits to solve my problems.

"You know, Pal Palych," without giving Simov a chance to be distracted, I said, "I have an idea. We have a technological division in the organization. There they engage in whatever they like, but not technology. The basis of the division are the sectors for information and standards. Now they are only getting in each other's way. So I suggest creating two independent divisions on the basis of the technological division: for standardization and scientific and technical information."

Simov's eyes positively sparkled:

"We are completely unable to find a chief for one division and you, Valentin Alekseyevich, are suggesting making the task at least twice as difficult."

"I will try to help, Pal Palych, if you will just resolve the issue in principle. Without two services our design bureau will not be able to stand firmly on its feet."

"Yes, you are probably right," Simov said, flustered. "But just try to find the candidates more quickly!"

Rylov and Ikonov

"Valentin Alekseyevich, my proteges have arrived," Gayev looked at me searchingly.

"Have them drop in in five minutes."

Gayev left and I gathered my thoughts and prepared for an important meeting.

On my advice Simov divided the technological division into two subdivisions: a division of standardization and a division of information. Now there was a question of chiefs, and the director reminded me of my promise. No matter how I tried, I still could not find candidates for these positions. And then Gayev suggested two engineers he knows. I agreed to talk with them.

And then they came into my office.

"Rylov, Leontiy Petrovich," a shortish man presented himself with a big smile.

"Ikonov, Gennadiy Sidorovich," a tall, imposing comrade said loudly.

"Have a seat, please," I said, shaking their hands.

I shuffled the papers on the desk and looked at my guests tensely.

Ikonov was a large, deeply tanned man, with a balding, protuberant brow. He was constantly licking his red lips. He appeared to be a profound thinker.

Rylov did not have such a profound expression on his face, but he was not so prickly, and somewhat softer. He had a small bald spot and wrinkled cheeks.

I asked the questions that are customary in situations like this and the guests answered. We discussed their work, their family situation, acquaintances we have in common--we "felt each other out."

Ikonov threw out short sentences, playing with his strong voice, repeating individual words. He spoke in a staccato.

There seemed to be something cunning in Rylov's eyes. But he was a kind and obliging person. His speech was soft, and his sentences were long and flowery.

If one considers that a good face is like a letter of recommendation, I was more impressed with Rylov's letter of recommendation. He seemed more modest and sincere.

"True, I have not worked very much in standardization, not very much," Ikonov repeated, "but I think that I can learn this job quickly. These things can be learned, they can be learned," he hummed.

"You can count on us, Valentin Alekseyevich," Rylov said ingratiatingly, "we are designers, we went to a good school, we have seen alot and we have experience. And you can be confident that if you recommend us Gennadiy Sidorovich and I will not forget it and will not let you down."

They said goodbye and left. I looked after the two men who were leaving, one of whom hardly reached the shoulder of the other, and I smiled: Mutt and Jeff. Well, they are alright. Ikonov, true, is a little bit impudent

Pressure

Time passed and I simply could not decide what to do about Gayev's proteges.

Simov reminded me several times about my promise to select new chiefs.

Gayev was also impatient.

"Decide, Valentin Alekseyevich," he said, "after all, you will have two reliable comrades in the organization."

Rylov and Ikonov called and reminded me about themselves.

The last conversation with Ikonov left me with an unfavorable impression. Gennadiy Sidorovich said that if I did not make a decision about hiring him within a week he would go to another place. This was pressure.

"It seems to me," I answered him in a metallic voice, "that your dealings with our organization should not tie your hands."

Having felt, apparently, that this step was inappropriate, Rylov came to me on the same day.

"Excuse me, Valentin Alekseyevich," Leontiy Petrovich said looking me in the eyes, "Gennadiy Sidorovich is now very upset. He has problems at home, and now he is worked up. And in general his external appearance is deceptive, he is a modest and cultured individual."

"Ikonov and I," Rylov continued, "will be trustworthy people for you, and you will tell us what to do and we will do it."

I waved my arms.

"Yes, yes, Valentin Alekseyevich," Rylov softly insisted, "we will do everything you tell us to do. You do not need to worry, I have unlimited influence on Ikonov. If you wish, I have him in my pocket."

I looked at the small Rylov with surprise.

"And another thing, Valentin Alekseyevich. I promise to fill your division with skilled designers. I guarantee two or three people. And in general, Valentin Alekseyevich," Rylov smiled, "trust us. You will not be sorry."

Having said goodbye to Leontiy Petrovich, I put Ikonov's and Rylov's personal files in a folder and went to Simov. I told him simply: it is better to have good friends than someone we do not know. Alas, I had to pay for this principle in selecting personnel

Tandem

There were 15 minutes left before the conference with Simov. I dialed the telephone number and heard again: "Gennadiy Sidorovich is not here. Leontiy Petrovich left also."

They are probably smoking in the corridor, I decided and left the office. I went up to the third floor and saw the two new chiefs at the end of the corridor. Tall Ikonov with a cigarette in his teeth was bending down to the short Rylov.

Yes, that is the way I have become accustomed to seeing the two friends: always together, always in some conversation, always cautious and composed. At conferences they agree and firmly support one another. A "friendly tandem" people say about them.

I greeted them.

"Valentin Alekseyevich!" The friends happily extended their hands.

"I have not been able to get hold of you since this morning," I said, looking at the clock. "The conference with the director begins now. The question is fairly slippery: the distribution of additional production space. I told you how our division needs an experimental laboratory. This is a matter of life and death for us. I really want you to support me."

"Well, what is there to discuss, Valentin Alekseyevich!" answered Rylov. "We understand perfectly well. We are designers ourselves!"

"We will support you, we will support you," hummed Ikonov, placing his hand on my shoulder and moving towards the director's office.

"And in general, Valentin Alekseyevich," Rylov added, "we must join forces. If we join together we will fear nobody."

"What does 'join together' mean?" I was surprised.

He gave me a steady gaze and smiled

"Well, Valentin Alekseyevich and his proteges!" Simov greeted us. "So we can begin!"

He looked at the people gathered there and began to discuss the difficult struggles in the rayon organizations, as a result of which he, Simov, had managed to gain additional space for the design bureau.

"Now," concluded Simov, "we must use this space wisely. Who has suggestions?"

I took the floor. I set out with a will to prove that the most necessary thing for the design bureau now is to create an experimental laboratory for my design and research division.

"Well, why are you getting so worked up, Valentin Alekseyevich," Simov smiled. "So far you have no opponents!"

Then other managers spoke. Each spoke about his own needs: about crowded conditions in the division, poor lighting, the need to expand the library

Rylov stood up. I tried to catch his gaze, but he looked only at the director.

Rylov gave Simov a compliment for "having scared up so much space that is in short supply," gave a positive evaluation to the latest organizational measures conducted in the design bureau, and went on to suggestions about utilizing the additional space. Looking at Simov, Leontiy Petrovich discussed the need to expand the area for reproduction equipment, about allotting a separate room for the archives, and about the need for acquiring new printing equipment.

"What are you talking about," I said, letting myself go. "What do you want, to create a printing shop here?"

"And why not?" Rylov parried.

He concluded without having said a word about my experimental laboratory. Ikonov spoke after him.

"The experimental laboratory and expansion of the divisions, including mine, of course, are important questions," Gennadiy Sidorovich minced. "But first of all we need to do what is advantageous for the entire organization. The entire organization," he repeated meaningfully.

"The boys' wheels are running in rhythm," I thought leaving Simov's office somewhat occupied.

Roughness

"May we?"

"Yes, please." Rylov and Ikonov sat down.

"Valentin Alekseyevich, we would like to have a serious conversation with you," Rylov began.

"What about my experimental laboratory?" I ejaculated.

"You, incidentally, have no reason to be indignant with us," said Rylov. "For we did not say a word against the laboratory."

"And not a word 'for' it either, even though I precisely asked you to."

Gennadiy Sidorovich and I felt that nothing would come of it. After all, you heard the opinions of the other chiefs.

"If you have supported me, everything could have ended differently."

"But . . ." Rylov opined. "You yourself, Valentin Alekseyevich, are to blame. You have somehow alienated Gennadiy Sidorovich and me. And you should not do that."

I did not like the last sentence. But Leontiy Petrovich continued:

"How many times have we proposed an alliance with you, and you do not want it. We have suggested gathering around a round table and you scorn the idea."

"I am always in favor of good relations and mutual assistance. But note--'mutual'!"

"True, Valentin Alekseyevich, assistance must be mutual," Rylov smiled slyly, "that is why we have come to you."

"You came to ask about Kislyuk?" I guessed.

"Precisely," Ikonov roared.

"Remember, Valentin Alekseyevich," Rylov moved right up to me, "Kislyuk is our friend. We promised to help you with designers and we have helped, we have recommended Kislyuk."

"Leontiy Petrovich!" I became heated. "I hired Kislyuk on your recommendation for the position of brigade leader, and it turned out that he is not even a good rank-and-file designer. You let him and me down. Now, taking your recommendation into account, I intend to reduce his wages by 10 rubles a month and demote him. I am acting against my conscience, I am causing a, as it were, disproportion in the position relations in the division, and you are still not satisfied!"

"Valentin Alekseyevich, how can we be satisfied, for it turns out that we have let the chap down. We promised him one thing and he receives another!"

"True, you let him down. But you let him down, and you want me to straighten it out, at the expense of my own conscience!"

"You are always talking about conscience!" Ikonov burst out. "As if we do not have a conscience!"

"Wait, Gennadiy Sidorovich, wait," Rylov stopped him, looking at me with alarm.

"Valentin Alekseyevich," Leontiy Petrovich's voice dropped almost to a whisper, "we beg of you: leave Kislyuk where he is, without any changes. He will be faithful to you. He is an excellent chap. And we will always be obliged to you."

"I cannot do that! It is not fair!"

"Valentin Alekseyevich," Rylov stood up. "We beg of you, do this for us."

"Well, I simply cannot! I do not have the right to do that! How will I be able to look my co-workers in the eyes?"

We were silent for a couple of minutes.

Ikonov and Rylov were smoking and looking at me hopefully.

"Do not be upset with me, boys," I slapped them on the shoulder. "The only thing I can do for you is to leave him in his position. I will take the 10 rubles and I will leave the position as it was before," I sighed deeply.

"There you have complied, Valentin Alekseyevich, there you have complied," Ikonov grinned.

"There is no reason for this," Rylov looked at me sorrowfully.

Friends

Now, after all this fuss, I have become much wiser, and I can even teach others something

Never hire friends! Especially as your subordinates. Some of them have to fight off temptations related to their more highly placed friend.

Gayev missed one deadline after another. I made him draw up a work schedule. Gayev did not meet the deadlines he set himself, was constantly changing the schedule, and then announced that there is no point in drawing up schedules and he refuses to do it. I could not let things develop of their own accord in the job and I insisted.

I thought that I was re-educating Avdey, but he was convinced that I was hounding him. In addition to all kinds of minor dissatisfactions, Gayev had one major grievance: he thought that I was shortchanging him on bonuses. I wrote down for him the same sums as for the other workers of his rank without guessing that Avdey thought he deserved more.

At the same time my relations with Barmin became more complicated. Grigoriy again spoke to me about the wage increment. I told him directly that he does not even deserve his present salary. Barmin flinched and with the words "the entire division relies on me" left my office.

Barmin's Course

"Excuse me, Grigoriy Avvakumovich," I put my pipe in my mouth and stood up. "We will have to stop. Simov is calling me."

"Please, go ahead, Valentin Alekseyevich," Barmin jumped up.

"Incidentally, Grigoriy Avvakumovich," I stopped and looked steadily at Barmin, "I do not like your frequent conversations with the director. I do not like it when workers go over my head to talk to the management. As experience shows, this does not lead to anything good."

"But we only discuss technical problems, Valentin Alekseyevich," Grisha placed his hand over his heart.

"But still I do not like these symposia!"

Having greeted me, Pal Palych dropped his eyes and for a long time shuffled the papers on his desk. Then he found some sheet of paper and with a cunning smile, handed it to me.

I read it quickly, taking the whole thing in, as usual:

Order

Taking into account the need to create in the subbranch _____ to organize a testing laboratory in the design bureau. The head of the laboratory will be Comrade Barmin, G. A., with a salary in keeping with the table of distribution.

I became short of breath. The blood rushed to my face. I looked at the appendix to the table of distribution. Barmin's salary would be increased by 30 rubles. Grisha got what he wanted. He thinks that he got it.

I sat for some time, shaken. What treachery! And I have done so much for him! And he . . . behind my back . . .

"Pal Palych!" I raised my eyes to Simov. "Is it really possible to do such things without consulting with me? After all, I know Barmin best."

"Well I am consulting with you," Simov went up to the writing desk and, looking in its mirror, combed his hair.

"You are not consulting, Pal Palych, but you are showing the head of the division an order about a new appointment of his co-worker."

"What do you mean, Valentin Alekseyevich," Simov sat down in his chair again. "This is just a draft of the order."

"Pal Palych, Barmin is not suitable for a management position."

"Why?"

"He cannot work with people. He looks down on everyone from the height of his dissertation. He is a poor organizer. He cannot even organize his own work well, and he is constantly avoiding work with the group. And, finally, he himself is not hard working enough."

"You, Valentin Alekseyevich, have made some very serious complaints against Comrade Barmin. The only strange thing is that you did not have them before," Simov's eyes sparkled cunningly.

"I had them before, but there was no need to discuss them."

"So," Simov continued, "the complaints are actually serious. But the fact is that we need an experimental laboratory. And I do not see another candidate for head of the laboratory"

"I will give you another candidate."

"Well all right, suggest one. Only, remember, not from another division."

I returned to the division almost running. I flung open the door and went up to Barmin's desk with large steps. He raised his eyes and looked at me frightened.

"I congratulate you on your 30 silver rubles!" Forgetting myself, I shouted at him.

Barmin's face was covered with white spots.

Statement

Simov ran the comb through his hair, straightened out his tie and turned to me.

Anton Fedorovich and I have called you in, Valentin Alekseyevich, on a serious matter.

I looked at Anton Fedorovich Olub'yev. Meeting my gaze, our party organizer straightened a lock of hair and winked with a large birthmark on his right eyelid.

"Tell us, Valentin Alekseyevich," Simov asked, "How are your interrelations with the division?"

I became tense. I have never learned to talk without being nervous!

"My relations are normal," I said, "Good! Both business and personal contacts are completely in order."

"And you have no enemies in the division?" Simov continued.

"No! Well only . . . well only Barmin was offended after a recent incident . . . but that will pass. I had a right to be offended at him as well."

Simov and Olub'yev glanced at each other. I became even more nervous.

"The fact is," Simov said slowly, "that a statement against you, Valentin Alekseyevich, came to the triumvirate."

I felt how I blushed, clenching and unclenching my fists several times, concealing a shudder, and then removing them from the desk altogether.

"Serious accusations are made in the statement. So Anton Fedorovich and I decided to call you in and straighten this out."

"And what kind of accusations?"

"Rudeness to subordinates," Simov read the list, "deception of the management, incompetence in technical matters."

Simov and Olub'yev looked to the side. I was silent for some time.

"Well, what can I say . . . As far as rudeness, this is a lie. Ask my co-workers. Incompetence? Not a single worthy idea that has come out of the division was suggested by anyone other than myself! And I make all the other technical decisions! And where have I deceived the management?"

"In the statement it says," Simov looked at the paper, "that in May you were absent from work for five days and on the time card they were counted as working days."

"Pal Palych!" I reproachfully turned my head. "You cannot but remember that in May I took leave from work on my days off, and I had an application for that which you probably still have!"

Simov turned around.

"Pal Palych! Anton Fedorovich!" I stood up. "Do you really not understand that this is slander. The revenge of someone who is offended and nothing else. Barmin will calm down and withdraw his vile paper."

"You think so?" Olub'yev said doubtfully.

"Tell us, Valentin Alekseyevich," Simov asks. "You are saying that Barmin is not objective toward you. And Gayev? Do you think one can believe him?"

"Gayev is an honorable person, he will not lie."

Simov and Olub'yev looked at each other meaningfully.

"You, Valentin Alekseyevich," Simov said after having been silent, "have a distorted idea about the situation in this division. You are too trusting if not naive. The fact is that this statement was signed by both Barmin and Gayev"

With Ikonov and Rylov

Ikonov and Rylov greeted me politely, like a capitulating general. They rose to greet me, shook my hand and even bowed while they were doing it.

"Why did you not warn me about the statement? Why did you not immediately put a stop to this squabble? After all, you knew beforehand!" I was disturbed. "Barmin and Gayev came to you!"

Ikonov and Rylov were taken aback.

"You are always that way, Valentin Alekseyevich," Rylov involuntarily squeaked, "you always have complaints and attacks. Can you not come and quietly and peacefully talk and consult. You are always offending and attacking, and that leads to no good. It is hard to fight alone"

Rylov came up to me:

"We have not let you down, Valentin Alekseyevich. It is just necessary to communicate and consult with us more."

Ikonov and Rylov exchanged glances. Rylov yawned and Ikonov cleared his throat and said:

"And in general the devil knows what is happening in our organization Orders are not fulfilled, plans fail, the premises are in a neglected condition."

"And we have poor order," I bitterly let drop. "But why do you tell me this on the sly? You should have brought this out in the open."

"Well, why?" retorted Rylov, "We have told Simov about this many times."

"Simov, of course, is not the manager. He is not the manager," repeated Ikonov. "There is reason to criticize him at a meeting . . . in a friendly way. But regarding a large matter."

"Well, I agree. Look, just do not be afraid!"

"Well what are you saying, Valentin Alekseyevich!" the friends were offended.

In Simov's Office

"You are apparently right," Simov turned his gaze from Rylov to Ikonov. "Kravtsov is informing the general about everything that happens here"

"We have long been assured of that," Rylov stood up. "We must take measures, Pal Palych."

"Ivan Vladimirovich will not give his okay," Simov spread his hands. "And in fact there is not sufficient substantiation. The statement is too weak,

Kravtsov has papers for his absence," Simov continues the list, "you cannot prove incompetence, and nobody confirms the notion that he is rude. And he has already defended the meeting with a protocol. And how did you allow that?" Simov laughed.

"Keep in mind, Pal Palych," Rylov moved forward, "that Kravtsov is always arousing the collective against you."

"Well, you are going too far there," Simov knitted his brows.

"We are not going too far at all," hummed Ikonov, "He intends to criticize you at the next meeting."

"Yes, yes," confirmed Rylov, "He said that himself."

"We shall see, we shall see," the director thoughtfully repeated.

Ikonov stood up and went to the window.

"Barmin and Gayev told me about disorders in the financial activity in Kravtsov's division," he said cautiously.

"Well check on that," Simov quickly responded. "Let the commission deal with that"

Commission

"And so, comrades, we have gathered here on instructions from the director of the design bureau in order to deal with the statement of Comrade Barmin concerning financial abuses of the head of the division, Comrade Kravtsov." Ikonov, without taking his eyes from the paper, adds:

"It is not one of the most pleasant matters, but I hope we will be able to dispense with it quickly. Has everyone read the statement? You have. So I shall not repeat it. What are the questions?"

"May I, Gennadiy Sidorovich?" Rylov turned to me. "Valentin Alekseyevich, in the first quarter no work was done on project 160. Why was the money funded?"

I was nervous, I shifted the papers and knocked over the ashtray.

"I hope that we can speak honestly and openly here?"

Everyone nodded in agreement.

"Well the work on the subject was started even before the financing was received, in the fourth quarter of last year. Therefore in the first quarter although we actually did not work on the subject, the money had to be included. For the work conducted previously."

"Valentin Alekseyevich," Ikonov squinted his eyes, "and in the second quarter the work was done by only one person, but 5,000 rubles were funded . . ."

"In the second quarter the director asked me to cover the underfulfillment of the plan by another department."

"Pal Palych, of course, will confirm this?" Rylov interjected.

"I hope so."

"Tell us, Valentin Alekseyevich," Rylov asked the question, digging through the papers all the time, "in the figures for the expenditures on the various subjects you indicate only the people who actually participated in the given project?"

"Frankly, this is not always the case. When covering past expenditures or underfulfillment by another division I have had to indicate in the figures workers who did not participate in the work."

"That is not good, Valentin Alekseyevich," Rylov reproachfully shook his head.

"I suggest," concluded Ikonov, "that Valentin Alekseyevich in an explanatory note frankly present everything that we have discussed here and we shall close this unfavorable case in a good way."

Volgin and Levin

"Well, Valentin Alekseyevich, they have given you a reprimand?" Volgin smiles.

"You can talk well, Viktor," I shook my head, "and you will not understand whether you are happy or upset."

"How did all this happen, Valentin Alekseyevich?" Levin looked at me with alarm.

"How did it happen? Gena and Lena duped me. I became sincere. They said write everything as it is and we will close the case. And they themselves wrote in the commission's decision: 'according to the explanatory note of Comrade Kravtsov, volumes were artificially inflated and expenditures were incorrectly entered. The reference to instructions from the management to cover the underfulfillment of the plan by other divisions was not confirmed.' They had another secret meeting with Simov."

"That's nonsense," Levin was disturbed. "And why do they need to do all this?"

"That's what I want to know," I shrugged my shoulders.

"It is clear that they need to," Volgin waved his hand, "Simov thinks that Kravtsov is scheming against him, and Ikonov and Rylov have their own scores to even. Yes, you have more than enough enemies. And you keep producing more of them. Just take the speech at the last meeting. Well, what is this: 'There is no beauty among the frontrunners, but among those in the rear' . . . witty, of course, but can one really simplify the competition to this extent! 'Running in place is generally conciliatory!'" Volgin teases. "And what about this statement that we give first place to the various divisions in turn? We have no poor ones!"

I looked steadily at Volgin.

"You are saying terrible things, Viktor Georgiyevich. You do not even understand how terrible. We have plenty of poor ones! And we must speak of them at the top of our voice. Not all of them have yet become"

"But still you cannot say that," Volgin insists. "You have offended the local committee, made the enterprise chief indignant, and insulted the people's control! When the shoe is on the other foot they receive their due. And you will be surprised about what they will ascribe to you!"

"Well what do you want of me, Viktor!" I almost shouted. "Do you want me not to speak? How can I be silent when they are continually demanding that the organization reduce time periods for planning and we have skilled designers in the design bureau who obtain up to 250 rubles and do not know how to draw a blueprint: they type on the typewriter, stand around the copying machines, gather and pack up blueprints and take them to the post office!"

"That is the way it is everywhere," Volgin interrupted me, "and it is not a big thing! Why must you stick your neck out? What changes after your speeches? Nothing! And you yourself teach everyone that wise prayer. How does it go?"

"Lord give me patience," I said slowly and deliberately, "to withstand the things I cannot change. Lord give me the courage to change the things I can. And Lord give me the wisdom to know the difference."

"You recited that remarkably. Why do you not follow these wise words?"

"Probably because God did not give me the third thing"

"God has given you everything," Levin interrupted. "But he did not give you a sense of self-preservation. No, you simply do not have it or else you would not speak out so much and pressure your enemies."

"No," I pounded my fist on the table. "Everything will turn out in the end!"

Conference

"Here we have," I glance over those in attendance, "the head designers of the projects, brigade managers and managers of the trade union bureau. We shall

consider the course of the work in the division and touch on several other things."

The first to report was Volgin. He discussed the difficulties with the plan for new technology for stamping shafts.

"We are not keeping up with the schedule. It is necessary to extend the deadline," he concludes.

Levin rises.

"Valentin Alekseyevich," he turns to me. "In order to proceed it is necessary to make a decision: to make a highly mechanized carousel installation or to stick with a simple stand."

"And what do you yourself think?" I asked him.

"Well, you know," Levin says, "The carousel machine, of course, is better, but . . . the stand has its advantages."

I sat silent for a couple of minutes.

"Well, all right, it is necessary to decide. Of course, the carousel installation is more advanced. But . . . under the conditions of our plants it would be difficult to manufacture and introduce it. Very difficult. I am inclined toward the simpler solution. Let us make a stand with the simplest elements of mechanization. The more so since we cannot take any risks in the present situation. We shall make the carousel machine in the next stage."

"Regarding other questions," I added, "Let us write in the protocol: beginning on the first to give Volgin another designer to help him. The deadline will remain unchanged. Are there any questions?"

"Permit me a couple of words," Volgin rises. "I, as a communist, can no longer tolerate the disgraceful things that are happening on the initiative of those two scoundrels, Rylov and Ikonov. I have already written a statement to the party bureau requesting that this be dealt with and the squabble be stopped."

"Correct," Levin supports him. "Those boys have gotten completely out of hand. Incidentally, they are spreading the rumor that Kravtsov is going to be removed."

Everyone looked at me curiously.

"As Mark Twain said," I tried to smile, "the rumors about my death have been strongly exaggerated"

"More information," I looked steadily at my co-workers. "Yesterday the general director called me in. One of the divisions of the association is being moved to a new building. Space is being freed next to the railroad station. It is considerably larger than the premises of our division. Ivan Vladimirovich suggested that we move to this building. The advantages: the possibility of organizing the experimental laboratory we have been hoping for and the independence of the division, which gives us hopes of a good future."

They were silent for a while and then there was a lot of noise.

"Simov arranged all this!"

"He wants to get rid of us!"

"The transportation is poor there!"

"There are a lot of hooligans!"

"The air is bad!"

"The premises there are terrible, the roof leaks and it is cold!"

"Incidentally," I explained, "Ivan Vladimirovich regards this as support of the department at a difficult time."

And I add:

"And I will not hide this from you: for this move the head of the department has been promised a personal salary and a promotion."

Everyone looked at one another disturbed.

"A number of people will leave" Levin's voice could be heard.

"The lighting is poor there!"--it was the trade union organizer.

"Let us move," Volgin stood up, "We will construct a shop there, we will fix it up and be comfortable there!"

"If it is necessary, Valentin Alekseyevich," Levin supports me, "we shall move."

"Well, of course, it is for you to decide. We are agreed," the others sadly give their support.

"Thank you, comrades," I concluded. "I shall think about it some more and give you my decision."

Decision

Olub'yev came into the office, straightening his hair.

"A short conversation, Valentin Alekseyevich," he said. "I spoke with the general director. Ivan Vladimirovich said that now after the division moves you will become a deputy head engineer. I heartily congratulate you, Valentin Alekseyevich. That is fair."

"Do not be in a hurry, Anton Fedorovich."

"Yes, Valentin Alekseyevich," Olub'yev continued, lowering his eyes, "I must confess. On an assignment from Simov I went to our instructor and explained that you could not have 'that' . . ." Olub'yev made an eloquent gesture, "from the results of the work of the commission and other materials."

"And what happened?"

"The instructor said that there were not enough facts. Then Simov demanded another commission. I would not be on it. In general, Valentin Alekseyevich, I had a serious talk with Simov. I submitted a number of complaints to him as the manager. And do you know what he said to me?"

Olub'yev placed his hand near his mouth and whispered in my ear:

"In a month I will not be here. And this means," Olub'yev continued loudly, "that some prospects are opening up for someone . . ."

"Keep in mind," Olub'yev looked me deep in the eyes, "I am your ally . . ."

As soon as Olub'yev left I took up the telephone and dialed the number of the general director.

"Hello, Ivan Vladimirovich. This is Kravtsov. I have some bad news for you: since I have the right to choose, I am rejecting your proposal. Why? I do not see that I have the moral right to transfer my workers to worse conditions."

"No, I am not playing at democracy. And I did not gather my people together for that. I am the one who has to make this decision. So that I can live with a clear conscience."

"No, it is very bad there, Ivan Vladimirovich. People will not understand me and they will say that Kravtsov has betrayed them. In the current situation this would be the final brush stroke in my portrait which has been painted by my 'friends.' I cannot allow myself such luxury."

"Excuse me, Ivan Vladimirovich, with your permission I answer 'no'."

"You are probably right, I am making a mistake and I will never really achieve anything. Again, excuse me . . ."

Evening. There is nobody in the division except myself.

A large design hall. Only five of the many lights are burning. The white rectangles of light look at me sympathetically like broad, open faces. The heads of the Pantographs have frozen, reminding one of well cranes. One hears no shuffling of papers, no sound of pencils, and the usual whispering and various voices of the design hall are gone.

Noise and voices rise up from the street. I go up to the window. In the weak light of the vestibule lanterns one can see the outline of two trucks with people milling around them. They are dragging desks, lamps, drawers and cupboards and lifting them up to the back of the truck. Ikonov's division is moving to the new premises near the railroad station. One can hear his loud voice: "Move it, boys!"

I leave the window. The voices quiet down. I return to my office and sit at the desk and hold my head in my hands.

Soon work will be completed on a new contact joint. The only thing left is climatic testing. This is earth-shaking work! An entire revolution in the subbranch: if only it is successful

The group of designers came to the plant to introduce a new heat-resisting coating. Here--with a good effect and with desire and a dissertation--but I do not have time for a dissertation now. If only it is successful

The manufacture of the test machine will be completed in a month. If only it is successful

The director's office was plunged in gloom. I walked from corner to corner, aroused by recollections. I would be glad to forget everything that happened, but it did not turn out that way

And maybe it is not necessary to forget anything? Perhaps this whole story taught me something? The future will tell.

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BOOK ANALYZES FACTORS AFFECTING LABOR EFFICIENCY

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[Review by B. P. Miroshnichenko, doctor of economic sciences, professor, Ye. M. Bubnova, candidate of economic sciences, docent, Moscow State University imeni M. V. Lomonosov, of the book "Problemy ekonomiki truda. Izbrannyye proizvedeniya" [Problems of Economics of Labor. Selected Works] by S. G. Strumilin, Vol III, Moscow, Nauka, 1982]

[Text] The name of the academician S. G. Strumilin is widely known in our country and abroad; he is called the patriarch of Soviet economic science. Stanislav Gustavovich boldly took on the most crucial problems of economics, sociology and many other disciplines, and was frequently a pioneer in them. His theoretical developments and hypotheses are confirmed by life. The expression "time is more costly than money" belongs to S. G. Strumilin. The scientist, who lived 97 years minus a couple of days, confirmed this by his personal example.

And here today (true, more than 20 years later) a new addition of S. G. Strumilin's book, "Problems of Economics of Labor" is being published--the third volume of selected essays prepared for publication while the author was still alive in 1956.

To whom is this book addressed? The older generation of workers has been educated on the works of S. G. Strumilin--the founder of the Marxist-Leninist approach to problems of economics of labor. During the past 20 years new "economic shoots" have matured. Young economists justifiably pay the tribute of respect to the scientist. But they are far less acquainted with his works themselves. Yet the problems of economics of labor are "eternal." Yet the depth and the care of the development of the problems posed by S. G. Strumilin and the high level of research he conducted to this day remain a standard, a model for imitation and guidance in action.

The first of the issues investigated in the book remains as crucial as before --"Classification of the Kinds of Labor." With scientific and technical progress the nature of labor changes a good deal, many of the occupations mentioned in the book have disappeared into the past and new ones have appeared, but the principle on which Strumilin's classification is based not only has

not become obsolete, but is worthy of entering the classics of analysis of labor problems.

Grouping occupations in terms of the degree of automation and the role of workers in the labor process, S. G. Strumilin determines the effect of laws of fatigue, norms of labor productivity, the effectiveness of methods of non-economic compulsion, and methods of incentives for labor. He has shown that psychological approaches to making labor more efficient are extremely varied for each type of labor: automatic reflex, semi-automatic habit, routine performance--"on order," independent within the framework of the assignment, and free creative labor.

Raising the question of the connection between such emotional-psychological factors as unpleasantness and also responsibility for labor, on the one hand, and problems of productivity and wage rates, on the other, S. G. Strumilin provides an example of the utilization of knowledge as the juncture of sciences--economics, sociology and psychology. Unfortunately, daily practice shows that the influence of psycho-physiological factors on the process of labor and its increased efficiency have been quite inadequately studied even today. It is even more disappointing that the points and principles formulated by S. G. Strumilin more than a half century ago are not being properly utilized.

A number of parts of the volume are devoted to problems of labor efficiency. He begins with the question of the prospects of labor resources. S. G. Strumilin constructs a hypothetical curve of the number of individuals of various ages before 1941, taking into account losses in the first World War and the civil war and from the famine at the beginning of the 1920's. He shows that after 1932 the damage to the labor force caused by demographic consequences will be less in evidence and labor force will begin to increase each year, reaching 18.6 million people by 1941 as compared to 14.3 million in 1920. Because of this, the ratio between workers and the mouths they have to feed will improve from 1:2.3 in 1920 to 1: 1.98 in 1931, and will worsen to 1:2.14 in 1941. "In passing" he made a brilliant prediction of the overall number of population.

S. G. Strumilin also relates the problem of improving labor efficiency to overtime work. It would be a mistake to think that this way of posing the problem is no longer meaningful in our time. "One should regard the main mistake in the struggle to increase labor productivity," emphasized the scientist, "to be the fact that up to this point in this struggle we have always proceeded along the line of least resistance, which at the same time has been the line of greatest achievements. In fact of the three paths--intensification, mechanization and rationalization of labor--the easiest is undoubtedly the first. Restoring piece-rate wages, awarding bonuses, fighting against absenteeism, publicizing labor Saturdays and, finally, increasing the working day through mandatory overtime work--all these are methods of increasing productivity as a result of the live force of the worker. And, as a result, everything that is gained through extreme intensification is lost as a result of failures to appear at work because of illness and other similar reasons."

Using the results of mass statistical observations the scientist showed that prolonged labor, even with an extremely low level of productivity, is more tiring than shorter periods of labor, even though it is more stressful. This situation leads to the question of improving the recreation of the worker through optimal utilization of his free hours. This question is considered in the seventh chapter of the book, "Towards Studying the Daily Life of USSR Workers." S. G. Strumilin draws the conclusion that it is first necessary to proceed toward reducing the least productive labor in the worker's household.

In the section devoted to the problem of labor skills S. G. Strumilin considered such factors as the level of education, change in the wage category as a result of age, the link between the size of the family and the age and skills of the worker, and the change in the wage category because of increased tenure. In essence he gives a factorial analysis of the structure and growth of national income that is created by complicated labor.

In the work, "The Economic Significance of Public Education," published as early as 1924, S. G. Strumilin, using materials from research on 2,600 Leningrad machine tool workers, revealed the dependency among each of the factors --age, occupational tenure and general education, on the one hand, and skills, on the other. On the basis of the methods he developed he calculated the average increase in skills depending upon the aforementioned factors. The methods that he introduced for the first time are still being widely used for processing factual material. Unfortunately, today many do not have the Strumilin "statistical art of economists." The correctness of the scientist's work consists in that his research was begun by substantiating the stability of the indicators he studied, the optimal size of the sample, the calculation of the average error of observations, and the average probable amount of error.

The results of S. G. Strumilin's investigation of economic aspects of education in the methodological aspects, for example, of the relationship between skills and talent are especially interesting. Original answers are given to the question of the objectiveness of self-evaluation of scientists and the adequacy of the size of the sample.

It seems to us that the period of the 1920's was a long time ago. But the works S. G. Strumilin wrote about it are crucial for the present. For example, in "Dynamics of Labor Conditions in the USSR During 1917-1927" he notes: "With a reduction of the real significance of earnings there is a real limit of elasticity, which it is inexpedient to transcend, primarily because 'if you do not give it,' the worker himself will take this minimum."

The last section of the volume, which is devoted to problems of labor productivity, is valuable. Here he reveals the concept of public labor productivity and elucidates various methods of calculating it, including the index that the author created. It is interesting the note the report "Science and Labor Productivity" made at the extraordinary session of the USSR Academy of Sciences in 1931 which for the first time raised the point that "under the conditions of the national economy science is called upon to be in the vanguard of technical progress, independently setting all new tasks for it."

The development of economic science is constructed on a solid foundation of Marxism-Leninism, on the assimilation of our theoretical heritage. An important place in this heritage belongs to the classicist of Soviet economic science, S. G. Strumilin. The study of his works will continue for many years to serve as an excellent school for each research economist.

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A JOB COMBINES ELEMENTS OF HOME, FAMILY, SCHOOL

Movosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1, Jan 83 (signed to press 23 Dec 82) pp 199-201

[Review by S. M. Sverev, general director, and O. S. Engel'brekht, socialist of the head enterprise, Ob' Leather Footwear Production Association (Novosibirsk) of the book "Vse o nas i nashem kollektive. Kontseptisii, metody i rezul'taty diagnostiki obraza zhizni kollektiva tiraspol'skikh shveytnikov" [Everything About Us and Our Collective. Concepts, Methods and Results of Diagnosis of the Way of Life of the Tiraspol Sewing Workers], by V. Solov'yeva, M. Kushina and V. Chichilimov, Kishinev, "Kartya Moldovenyaski", 1980, 376 pages]

[Text] The book "Everything About Us and Our Collective" came to us in a form which shows that it already has many readers. This means that it is interesting and it would be good for us to read it ourselves.

At first we thought that this might possibly be another "factory-plant story," of which there were quite a few sometime ago. But the authors, the general director of the Tiraspol Sewing Association, V. Solov'yeva, and the sociologists in the Foreword state: "We shall not return to questions of the history and production life of the factory" (p 5). They make what might be called a copy of the enterprise, a photograph, and consider it from all sides. And there are more than 800 of these sides (this is the number of questions in the questionnaire) plus the interconnections among them.

Passports for enterprises are a widespread phenomenon today. But frequently one does not understand how to apply them, how to use the indicators contained in them. The authors of the book share with the readers their experience in a scientific approach to the social life of the collective, thus revealing methods, techniques of analysis, and devices for working with sociological information. In a word, we are not only shown a "photograph," which reproduces the production situation, the attitude toward labor, ideological and educational work, socio-political activity, the socio-psychological climate, reconstruction of the process of communication, crucial problems of life and the attitude toward leisure, the family and family relations, the demands and interests of the workers (here we have listed the sections of the book). We are also given a look at the "social laboratory," in order to reveal and clarify the methods of operation.

Books on a similar theme have appeared in literature, but those devoted to our light industry are still pioneers. It is no accident that the authors complain that they could not draw a comparison with other enterprises of the sewing branch, for many of them have not conducted a single sociological investigation (p 63).

How is it useful to visit the social "kitchen" of the Tiraspol association? One becomes familiar with the work techniques, which we do not know very well and cannot carry out ourselves, and also because we are eager to see how other people handle things. We become familiar with the "handwriting," in other words, with the approach, concept and methodology, without which any "social cross-section," even the technically most perfect one, will look like an odd job, and not an inspired idea.

The book describes a concept, and there is an idea, a clearly expressed design. They are clearly expressed by the words of Comrade L. I. Brezhnev: "For a person the collective in which he works is a kind of home and family and school." The Tiraspol sewing workers have set for themselves the task of creating precisely such a collective. Such as the one described in the book.

Today much is being said about the fact that a comprehensive approach to educational work in the collective is an especially important problem. But what is this? Not in theory, but in practice? What is a comprehensive system of education? How does one approach forming a way of life for the workers, taking advantage of socio-psychological methods of influence on them? Today it is not enough to pose these questions; they must be answered. The book under review is a good aid to the manager. The plan of a comprehensive system of education proposed in it combines both the ideas of scientists and many years of experience of a manager in practice and a skillful psychologist.*

Working on creating methods of social control, the authors, naturally, have found it necessary to act comprehensively. A comprehensive approach to arranging educational work at the enterprise is defined by them as a controlled totality of goals, final results, objects and institutes of education, methods and means that correspond to the specific features of the socialist production collective, its capabilities and its prospects for social development.

We have had occasion to hear that sewing workers with their social control penetrate into intimate spheres of the lives of people which cannot properly be touched upon. Like photographing through a keyhole. These assertions seem unjust to us who are familiar with the system both from the book and from first-hand experience. The authors themselves interpret the specific features of education under the conditions of socialist production collectives as follows: the industrial enterprise is not a purely educational institution. . . . Here one must provide for a unity of economic and educational activity that corresponds to the functions of the enterprise as the main unit of the socialist society" (p 348).

*Concerning the association's work experience see the selection of materials, "Key Factor" -- EKO, No 1, 1980.

The book also draws attention to the fact that it reflects the activity of the sociological service of the industrial enterprise. The laboratory of the Tiraspol sewing workers, having travelled the path from one sociologist to the base branch laboratory, provides an example from which one can be oriented. This path was simultaneously a changeover from solving local, separate social problems to control of the process of influence on all aspects of the vital activity of the collective.

They have determined--and this is very important--the content and forms of interaction of social control with other functions of control, and basic tasks that go far beyond the limits of the widespread technology "research--recommendations" of sociologists and orientation toward the final result. The book demonstrates how the activity of sociologists contributes to the achievement of high indicators for the association, so that we are again convinced of the need to create a good sociological service in our association.

In conclusion we should like to say: "Everything About Us and Our Collective" is a very useful discussion not only of today's collectives, but also of future ones, and it points the way for others.

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IMPORTANCE OF TRACE ELEMENTS FOR GOOD HEALTH STRESSED

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[Article by Yelena Vigdorchik (Moscow): "Trace Elements Guarding Health"]

[Text] When do we think about our diet? As a rule, only when it becomes almost impossible to satisfy our desire to preserve our health and figure. A fairly large amount is being written about the fact that it is necessary to maintain correct nutrition and a correct diet, but these articles are read mainly by people who have already fallen ill. Unfortunately, we rarely think about the fact that our diet predetermines not only our external appearance, but also our health.

And yet doctors consider the nutrition factor to be one of the leading causes of disease. But today we shall speak about only one aspect of the problem "nutrition and health," namely the role played by trace elements in maintaining our health, especially since unexpected economic aspects appear in this discussion.

Magnesium, the Heart and Arteriosclerosis

Everyone's organism is constructed the same, but we all have different diseases. For example, for Europeans arteriosclerosis is, one might say, a customary disease, while for the African Bantu tribe it is something unheard of. Why is this? Many physicians think that the solution is this: the typical diet of Europeans is far poorer in magnesium than that of the Bantu tribe. And yet if the organism does not have enough magnesium there is a suppression of the process of synthesizing lecithin, which plays an important role in the exchange of cholesterol--the main cause of arteriosclerosis. When experimental monkeys stopped receiving products that contained vitamin B₆ and magnesium, they quickly gained weight and arteriosclerosis began to develop in them. Draw the conclusions yourself.

A shortage of magnesium is no less destructive to our heart. As early as 1970 figures were published concerning the fact that in people who died of myocardial infarction the magnesium content in the area of the damage was approximately 42 percent less than in the hearts of healthy people who died in automobile accidents. The shortage of magnesium also gives rise to such a widespread pathology as cardiac arrhythmia.

Are you familiar with the sensation: a sudden dizziness, twitching of the eyelids, especially the left one; rapid fatigue, frequent headaches, poor concentration; sensitivity to changes in the weather; heart palpitations, arrhythmia frequently accompanied by a severe pain in the chest cavity; insomnia, nightmares, night sweats, morning fatigue? If not all, then some of these ailments, according to a number of specialists, are caused by a shortage of magnesium in the organism.

The reason, for example, for morning fatigue is frequently this. Usually the hormones which make it possible for us to stay cheerful throughout the day (corticosteroids) are emitted in large quantities by the adrenal glands about 6 a.m. But when there is a shortage of magnesium the maximum of corticosteroids come in the evening, and therefore in the morning we feel worn out, while toward evening an influx of energy rolls over us, but then sleep comes and the working day is far behind us

Scientific research shows that in order to maintain health a person needs about 350 milligrams of magnesium a day, while in fact we barely receive half of this. What factors have given rise to this shortage and how do we eliminate it?

The first factor is soft water which does not contain enough salts, either because of the peculiarities of the soil or because of the fact that it is boiled. American researchers have shown that adding mineral substances to water, which increases its hardness, in four years reduced the death rate from cardiovascular diseases to almost one-half. In the cities where hard running water is used, the residents have a lower average blood pressure, a lower cholesterol level and a slower pulse rate.

The constant application to the soil of potassium fertilizers which do not enrich it with magnesium salts leads to a reduction of the magnesium content in plant products. Many physicians also see the excessive use of tranquilizers as one of the reasons for magnesium deficiency in the organism.

But perhaps the main reasons for magnesium deficiency in our organisms lie in incorrect nutrition and the excessive zeal of the food industry which produces high-calorie products. For example, when wheat is processed in milling it loses more than 70 percent of the magnesium contained in the grain. Approximately as much is lost when processing buckwheat. Refined sugar contains 1-200ths of the amount of magnesium that its byproduct, black molasses, contains. And we ourselves, when we peel potatoes, lose 35 percent of the magnesium contained in this product.

According to estimates of French physicians, approximately 50 percent of the population of their country suffer from magnesium deficiency. In countries where people eat a lot of natural foods that have not been industrially processed, for example, in Finland, practicing physicians encounter almost no patients with kidney stones.

But enough threatening words and facts. Let us answer the question: what products must be eaten in order to avoid a magnesium deficiency in the organism. First of all it is contained in poppy seeds--526 milligrams per 100

grams, dried green beans--253 milligrams, soybeans--322 milligrams, millet--289 milligrams, barley groats--274 milligrams, peas--187 milligrams and oat flakes--133 milligrams. As for bread, give preference to bread made of coarse ground flour; there is not a trace of magnesium in white buns.

That Magical Zinc

They knew that zinc ointment accelerates healing of wounds 5,000 years ago in ancient Egypt. Nonetheless it was not until the 1950's that medical science officially recognized the large role of zinc in our organism. Then announcements of more and more new miraculous properties of zinc poured down as from a horn of plenty. For example, it was explained that taking zinc preparations:

reduces the time of healing of post-operative wounds by almost half;

accelerates the healing of serious burns;

normalizes the growth and appetites of children;

provides an effective preventative of catarrh in the upper respiratory tracts and also many virus diseases;

halts the development of rheumatism and prevents its appearance in healthy people;

accelerates the cicatrization of stomach and duodenal ulcers;

heals such a widespread skin disease as acne;

prevents and heals certain diseases of the prostate;

prevents the development of senility

Having filled your heads with this list of positive effects, let us ask some questions: how much zinc should a person have each day and where does he obtain it? The answer to the first question is 10-20 milligrams, but even 10 times this much will not harm the health. The surplus zinc is simply removed from the organism (we are not considering cases of zinc poisoning, which are also possible, but are encountered, as a rule, when hygienic norms are not observed in production). As for products containing zinc, oysters are the richest in it, containing 270-600 milligrams per kilogram, but they are exotic in our menu. Fortunately, more available products are also rich in zinc, such as:

wheat bran and wheat sprouts--130-202 milligrams per kilogram;

mushrooms (especially butter mushrooms, birch mushrooms and champignons)--75-140 milligrams per kilogram;

coarse ground wheat flour (or bread made from it), oatmeal, barley, cacao, molasses, egg yolks, rabbit and chicken meat, peas, beans, dry yeasts--20-50 milligrams per kilogram;

cucumbers, garlic and brown rice--8-20 milligrams per kilogram.

Everything is clear about garlic, green beans, mushrooms and many other things. But how does one obtain and prepare wheat sprouts--this requires an explanation. Fortunately, it is not difficult. Take 3 cups of tap water at room temperature and place a nylon tea strainer in each cup. One can also place a piece of an old stocking in a metal strainer. In each strainer place 1 or 2 spoonful of wheat grain and fasten it in such a way that the water covers the grain. "Load" one cup each day so as to have fresh sprouts all the time. The grain begins to sprout on the third day. It is eaten when the sprouts are about 3 millimeters long. The water in the cups must be changed every day. One can eat from 1 to 3 spoonful of sprouts each day. In addition to zinc, the sprouted wheat is rich in iron, lime, phosphorus, magnesium, selenium and other trace elements which are extremely valuable for our health, and also vitamins E and the B group.

One can advise gourmets to prepare creams of wheat sprouts. To do this one uses a mixer to puree the contents of one sieve until it is smooth. Add egg yolks and powdered sugar to taste and something for aroma (vanilla sugar, cocoa, grated chocolate or jam). Mix all this with whipped butter or margarine and stir it until it is a smooth cream, to which you add a spoonful of vodka in order to eliminate the aftertaste of the margarine. This cream will embellish any homemade torte.

Two-Faced Selenium

What do we know about selenium? It comes to mind that selenium is the basis of photo elements. And another thing, it seems, poison Yet medicine has established that selenium has another important property: it is quite necessary for normal functioning of the human organism. And although man's need for selenium is miserly--only 0.00001 grams per day, a shortage of it exacerbates cardiovascular diseases and makes their treatment difficult, and it considerably reduces resistance to cancers.

How does one provide the organism with an optimal dose of selenium? The very "problem of selenium" is a new one, and it came up because of three factors: modern methods of agricultural work, industrial processing of food products and the increased proportion of hydrocarbons in our diet. Hydrocarbons are the main enemies of selenium. Sweets can completely destroy selenium and therefore by avoiding sugar we save selenium. But before saving, we must introduce it into our diet. All kinds of "gifts from the sea" are extremely rich sources of selenium: fish, especially herring, and sea salt, which can completely replace unpurified rock salt (we shall discuss this later). Of the "land products" the main sources of selenium are corn, yeasts and garlic. Since not all strains of corn are rich in selenium, yeasts and garlic are more reliable.

Yeasts, especially brewer's yeast, not only contains a good deal of selenium, but also it is in the most easily digestible form and has great biological activity. A dose of yeast is not great--only 2 grams a day. Yeasts must be poured into boiling water in order to "break them down." The fact is that

they continue to live for some time in the intestines, nourished by the very valuable vitamin H, which is responsible for immunity. Yeasts that are mixed in boiling water lose this undesirable property. They should be drunk without sugar in order not to bind the irreversible selenium. This is not very tasty and therefore the water can be replaced with milk or a drink called "False Brains" can be prepared from the yeasts.

It is simple to prepare it: stew a cut onion, adding a spoonful of vegetable oil and a couple of spoonful of water so that it is not browned, but just becomes soft and white. Add 3-5 grams of baker's yeast and mix it until it is smooth. Make sure that the contents of the pan do not burn. Beat into the mass 1-2 egg whites and stir until it becomes thick. Remove it from the heat. Add salt, pepper and oil to taste, sprinkle it with parsley and enjoy it with bread or potatoes. It is quite enough to prepare this feast 1-3 times a week. If you have recently been ill and need to remove the toxic compounds that remain in the organism after the illness, this dish can be prepared more frequently and selenium can be added in the form of those same sprouted grains of wheat.

A source of selenium that is just as good but is less of a bother is garlic. In order to evaluate its favorable influence on the health of the population it is sufficient to look at the figures that characterize the average annual death rate per 100,000 residents from heart diseases and high blood pressure in the following countries:

| Country | Death rate from heart diseases | Death rate from high blood pressure |
|---------------|-----------------------------------|--|
| United States | 319.5 | 39.1 |
| Italy | 208.9 | 35.4 |
| Spain | 71.3 | 13.9 |

One of the explanations for the sharp difference between the United States and Spain is the passion of the Spanish for garlic. It is no accident that even in tourist brochures Spain is called the "country that smells of garlic." Italians eat a great deal of garlic, although they eat approximately half as much as they do in Spain which, alas, is reflected in the figures presented in the table.

Additionally, garlic contains a good deal of iron, magnesium, fluorine and vitamins of the B group. This entire complex has a favorable effect not only on the cardiovascular system. Garlic reduces the content of sugar in the blood, prevents diabetes, and makes an excess of cholesterol in the organism less dangerous. It is no accident that among the Ethiopians, in spite of the fact that they have the world's highest average level of cholesterol content in the blood, arteriosclerosis is an extremely rare disease: in this country they love garlic. We know of articles published about experiments that confirm that garlic halts the division of cancer cells and in some cases has prolonged the life of cancer patients.

Garlic oil is especially effective. Unfortunately, neither our food industry nor pharmaceutical enterprises produce it.

The Known and Mysterious Iron

It would seem that we have no problems with iron: we do not need much of it --approximately 15 milligrams per day, it is contained in almost all food products and it is almost not eliminated from the organism (except in cases of bleeding). But nonetheless many physicians and dieticians think that a shortage of iron is a frequent result of an incorrect diet.

There are three main reasons for the inadequate consumption of iron:

little physical activity and various weight loss diets when we receive too little food and too little iron;

significant changes in the diet in favor of products which either do not have iron or it is in a form that is difficult to digest;

consumption of a large quantity of highly processed products (refined sugar, table salt, white bread and polished rice) with the simultaneous entry into the organism of a large quantity of phosphates, which impede the assimilation of iron (phosphates enter our organism in a large quantity with vegetable products, especially if phosphorus fertilizers are used for raising them).

Unfortunately, providing the organism with a sufficient quantity of iron is still a problem. Not only in developing countries (such as India), but also in industrially developed countries, according to estimates of physicians, the consumption of iron is approximately one-third of the norm.

A shortage of iron in the organism slowly leads to anemia, reduced resistance and various causes of diseases. Therefore it is extremely important to adhere to the following principles in nutrition, whose observance will make it possible, if only partially, to make up for the shortage of iron:

eat as many natural foods as possible, which have not undergone technological processing;

be sure to include in your diet products which contain a good deal of iron;

remember vitamin C, it helps to assimilate iron.

So, which products contain an especially large amount of iron? The food that is richest in iron is liver: calf liver contains 12 milligrams per 100 grams, and beef liver--7 milligrams. But it is also possible to enrich your diet with iron through less expensive and more available products. For example, 15 grams (1 liter) of molasses, which we mentioned above, a byproduct of the sugar industry, contains 3.2 milligrams of iron. A good deal of iron is also contained in wheat sprouts--3 milligrams per 30 grams, and also prune juice, dried apricots, nuts, melon seeds and sunflower seeds. The most available source of iron is bread made of coarse ground flour. One kilogram of

this flour contains 30 milligrams of iron, while 1 kilogram of processed flour contains only 8.2 milligrams. Since bread appears in our diet every day and we traditionally eat a great deal of it, this is what will be the main source of a number of trace elements until the food industry changes its views on salt. Why namely salt? Because:

Salt--The Main Source of Trace Elements

Some readers will be surprised: doctors are calling for a reduction in salt consumption, and we are extolling it? It is quite true that the doctors are waging an absolutely correct anti-salt campaign. But the fact is that we are speaking an entirely different kind of salt. Physicians are speaking about the harm of cooking salt which is produced by our food industry, but it is almost pure sodium chloride: according to the GOST, ekstra salt should contain no less than 99.7 percent sodium chloride, salt of the high grade--no less than 98.4 percent, and salt of the first grade--no less than 97.7 percent. Yet the production of salt and the evaluation of its quality in terms of the lack of impurities, in the opinion of a number of specialists, is not at all an achievement of the food industry.

The fact is that rock salt and sea salt contain, in addition to sodium chloride, all of the trace elements that are most valuable to our healths: iodine, magnesium, lithium, selenium, zinc and tin, but in the process of purification by leaching all of these substances are removed.

So the whiter the salt in our salt shakers, the less valuable it is. This is also shown by the fact that in countries where salt is obtained by the traditional ancient method--evaporating sea water in the sun (in Spain, Venezuela and Japan) one very rarely encounters such diseases as leukemia and arteriosclerosis, and in the death rate from infarctions and the number of psychological diseases are much less.

We can reply that the USSR produces salt with supplements of trace elements. And we have salt blocks for animal husbandry, but the proportion of these in the overall volume of salt production in 1980 amounted to only about 1.3 percent and they were intended not for people but for livestock. A paradox! On the one hand the output of salt blocks means that the usefulness of trace elements, at least for livestock, is recognized by our food industry. But why then do they not produce enriched salt for food purposes? On the other hand the food industry has begun to purify salt of all trace elements and then these same trace elements are specially introduced into it (if in somewhat different proportions), which increases the production cost of the salt blocks per 1 million rubles' worth of their annual output.

One must say that the authorized commission of experts of the USSR State Committee for Prices, under the chairmanship of Professor Yu. V. Yakovets, as early as 1980 noted the narrow assortment of salt sold to the population and recommended that it be significantly enriched with various vitamins and medicinal supplements and also trace elements. The commission also included representatives of the USSR Ministry of the Food Industry, who signed the conclusion. But up to this point one does not see food salt with trace elements on the counters of the stores.

Let us sum up the results: the national economy is annually losing many millions of rubles on purifying salt of trace elements while at the same time annually expending more money on the production of medicines to treat diseases that are caused by a shortage of these trace elements (not to mention expenditures on bulletins, wages of physicians and other large expenditures in the sphere of public health).

Of course the population has become accustomed to the whitest salt and the return to the gray unpurified salt can cause a certain amount of prejudice. But people today are listening so attentively to medical propaganda that the assertion of the possibility that 10 grams of gray salt will satisfy no less than half of man's daily need for iron and other vitally important trace elements will undoubtedly produce results.

Let us end our survey of special articles on this extremely important subject concerning the influence of trace elements on our health with this praise of unpurified or enriched salt.

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SENSIBLE EATING HABITS SUPPLY MOST NUTRITIONAL REQUIREMENTS

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 1 Jan 83 (signed to press 23 Dec 82) pp 212-216

[Article by L. Ye. Panin, doctor of medical sciences, Institute of Clinical and Experimental Medicine (Novosibirsk): "The Therapeutic Diet"]

[Text] Ten years ago in the United States 4 billion dollars were spent on prescription drugs, and 2.6 billion dollars on self-treatment. Today these figures are even more astonishing. In the modern civilized world various pharmaceuticals are consumed in immense quantities. All kinds of sleeping pills, tranquilizers, pain killers, mood elevators, stimulants and other tablets and pills can be found in the medicine cabinet of any home. Many people are dependent on these drugs throughout their life.

In order to protect our health, we invest immense amounts of money of the pharmaceutical industry, medicine and public health. Pharmaceuticals are an integral part of our culture, and we cannot even imagine our existence without them. From the standpoint of common sense it is quite impossible to understand why man is drawn primarily to pharmaceuticals and forgets about the therapeutic properties of food. During the times of Hippocrates and Avicenna people understood better than we do that one cannot draw a sharp boundary between food and medicine. This view is retained perhaps only in the medicine of the countries of Southeast Asia. And is this not why we are now turning again to the experience of Tibetan medicine and beginning to recognize that the path we are following today is not the best one?

Trying to overcome nature, we latch onto to various variants of "rational nutrition": vegetarianism, cheese diets, the Shelton diet, the French diet, the protein diet, and, finally, various degrees of fasting and so forth. All these are extremes which are frequently unacceptable not only for a sick person, but also for a healthy person. And even if we need to use therapeutic diets, this should be done only on the advice of a physician.

The modern food industry, following the pharmaceutical industry, strives to produce products with a high degree of purity, which is used as an indicator of quality. A questionable criterion. The assortment of refined products increases each year. Certain fats, groats, fine milled flour and items made of it, sugar, salt and vodka--all these are beginning to compete with chemically pure substances in terms of the degree of their purity. Refined sugar

is 99.5 percent sucrose, vodka--40 percent alcohol, and salt--99.6 sodium chloride.

But one must understand that by purifying food products of toxic and ballast compounds we lose a large quantity of absolutely necessary biologically active substances--vitamins, trace elements, natural adaptive substances, that is, we are throwing the baby out with the bath water. All this leads to the development of malnutrition.

Today even in economically developed countries where it would seem there would be no shortage of food products the population suffers from a shortage of vitamins caused by foods made of highly refined products. Many countries are solving this problem by artificially adding vitamins to food products. Thus in the majority of developed countries and also in many developing countries adding thiamin, riboflavin and nicotinic acid to flour and adding vitamins A and D to margarine are a compulsory measure which is reinforced by legislation. The content of vitamin C in fruit juices is being standardized. In the United States in 1974 a program was adopted which envisions enriching all flour produced in the country, regardless of the grade, with thiamin, riboflavin, niacin, folic acid, peridoxin, vitamin A, iron, calcium, magnesium and zinc in quantities so that 400 grams of flour will provide the recommended daily allowance of consumption of these elements. A similar program has been in effect in Canada since 1978.

The diseases that can be caused by an inadequacy of various trace elements in the organism is discussed in the article by Ye. Vlgdorchik. In the human organism the exchange of vitamins and trace elements is closely interrelated. When investigating the population of the Asian northern part of our country we came across a situation where the assimilation of vitamins depends on the content of trace elements in the food products. In the north there are very few minerals in the water. Frequently man must drink melted snow and ice which contains few trace elements. This leads to a reduction of the assimilation of vitamins by the intestines. Man develops secondary vitamin deficiency, which must be treated not with vitamins but by supplements of the corresponding trace elements and elements needed in larger quantities. Under the given conditions it is extremely expedient to add vitamins to natural products. The appearance in the organism of various vitamins and trace elements together is more effective from the standpoint of their mutual assimilation.

Having our own experience in this area of medicine, we have come to the conclusion that there is a weak dependency between the development of arteriosclerosis or high blood pressure and a shortage of magnesium or selenium. Man's need for magnesium, for example, is satisfied, as a rule, without difficulty. Magnesium is among the 8 elements that are the most widespread in the earth's depths. An abundance of it enters the human organism. But even with an optimal content of magnesium, selenium and other biological elements, arteriosclerosis, ischemic heart disease or arterial hypertonia develop quite successfully under the conditions of prolonged emotional strain. But a shortage of magnesium in the organism undoubtedly creates a favorable background for this.

We should like the reader to avoid the somewhat direct interpretation of the development of pathological conditions that was discussed in the article by Ye. Vigdorchik. It is more important to pay attention to the more general problem which the author raises: this is the large changes in the nutrition of modern man. The consumption of significant quantities of hydrocarbons and refined products, the increased calorie content and the entry into the organism of toxic compounds which appear in food products when their technological processing is not perfected--all this cannot but be reflected in our health and in the health of future generations. Here we must recall all aspects of the problem. It is not only useful, but also advantageous for man to eat sensibly: for health is an economic category!

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MURPHY'S LAW, ASSOCIATED COROLLARIES

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[Article by Artur Blokh, translation by L. Belyayeva: "Murphy's Law"]

[Text] Murphyology

Murphy's Law. If anything bad can happen it will happen.

Consequences.

1. Nothing is as easy as it seems.
2. Any work requires more time than you think.
3. Of all the bad things the one that causes most harm will happen.
4. If four cases of possible bad things have been eliminated beforehand, a fifth will always be found.
5. Left to themselves, events have a tendency to develop from bad to worse.
6. As soon as you decide to do one job you will find another which must be done first.
7. Any solution produces new problems.

Chisholm's Second Law. When things are going well, something should happen in the very near future.

Consequences.

1. When things are going as bad as they possibly can, in the near future they will go even worse.
2. If it seems to you that the situation is improving it means that there is something you have not noticed.

Chisholm's Third Law. People understand any sentence differently from the way it was meant.

Consequences.

1. Even if your explanation is so clear that there can be no incorrect interpretation, a person will still find a way to understand you incorrectly.
2. If you are confident that your action will meet with universal approval, someone will inevitably not like it.

Scott's First Law. It is not important that something is not proceeding correctly. Perhaps it looks all right

Finagle's First Law. If an experiment has succeeded something is wrong here

Finagle's Third Law. In any set of initial data the most reliable quantity which requires no verification is erroneous.

Finagle's Fourth Law. If a job has already failed any attempt to save it will only make things worse.

Erman's Commentary on Ginsberg's Theorem.

1. Things will get worse before they get better.
2. Who said that they would get better?

Everett's Second Law of Thermodynamics. Confusion in society is constantly increasing. Only by persistent labor can it be somewhat reduced. But this attempt itself will lead to increased overall confusion.

Murphy's Law of Thermodynamics. Everything gets worse under pressure.

Podder's Law. Everything that begins well ends poorly. Everything that begins poorly ends even worse.

Stockmeyer's Theorem. If it seems that it is easy to do the work, it will inevitably be difficult. If it appears to be difficult this means that it is absolutely impossible to do it.

First Law of Creation of Dynamics of the Zimergy Systems. If you have already opened a can of worms, the only way of sealing them up again is to use a bigger can.

Applied Murphyology

Booker's Law. Even a small practice deserves a large theory.

Klipstein's Laws Applied to Machine Building.

1. Your application for a patent will inevitably be a week later than a similar application submitted by someone else.
2. The stability of deliveries is always in inverse proportion to the tightness of the office schedule.
3. Any wire cut into pieces turns out to be too short.

Klipstein's Laws Applied to Creation of Experimental Models and Production.

1. Permissible deviations will accumulate in one direction so as to cause maximum difficulties in assembly.
2. If the design requires n parts, the warehouse will have $n - 1$.
3. The engine will turn in the wrong direction.
4. The system for ensuring reliability will cause other systems to break down.
5. An instrument protected by a fast-acting fuse will be able to protect that fuse by being the first to overheat.
6. A mistake will appear only after the final testing of the instrument.
7. After the last of 16 bolts is screwed into the protective housing it will turn out that it was the wrong housing.
8. After the housing is fastened by 16 containment bolts it will turn out that you forget to put the gasket inside.
9. After the installation is assembled extra parts will be found on the bench.

Universal Laws for Young Engineers Developed by the Committee for Practical Recommendations of the International Association of Engineer-Philosophers.

1. Any mistake which can hide in any calculation will be there.
2. Any mistake in any calculation will find a way to cause the greatest harm.
3. In any formula, constants (especially those that are taken from technical references) must be regarded as variables.
4. The most important dimension in any diagram or blueprint has the greatest chance of being omitted.
5. If an experimental installation works irreproachably, all the rest of them will malfunction.

6. A request for changes which absolutely must be made in the instruments will always come in after its manufacture is almost completed.
7. Parts which simply cannot be assembled incorrectly will always be assembled incorrectly.
8. All deadlines on commitments for deliveries must be multiplied by a coefficient of 2.0.
9. Technical specifications of instruments announced by the manufacturing firm must be multiplied by a coefficient of 0.5.
10. Expectations of the consumers of a new machine must be multiplied by a coefficient of 0.25.
11. Any device which requires adjustment and regulation usually receives neither one of them.
12. If more than one person is responsible for a mistake in calculations, the guilty party cannot be found.
13. Identical instruments inspected by identical means will always behave quite differently in operation.

The Atwood Consequence. They "borrow" only those books which we especially value.

Johnson's Third Law. An issue of a magazine that you have lost contains precisely that article, discussion or excerpt of a novel which you want to read immediately.

Consequence. All of your friends either do not have this issue, or have lost it or have thrown it away.

The Law of HARPER'S MAGAZINE. A thing cannot be found until you have purchased one to replace it.

Richard's Rule of Interdependency. Anything you have kept for long enough can be thrown away. As soon as you throw it away you will need it.

Law of the Airplane. When your airplane is late, the airplane to which you wanted to transfer departs on time.

The First Law of Riding a Bicycle. Regardless of where you are going it is uphill and against the wind!

First Law of Bridge. Your partner is always to blame.

Law of the Cat's Continual Predicament. As soon as the cat has stretched out and started to sleep on your lap, you immediately must get up and go, well, say, to the bathroom.

Johnson and Laird's Law. A toothache usually begins on a Saturday night.

Ettore's Observation. The next line always moves faster.

Bub's Law. Anything you have lost, you will always find in your other pocket.

(Continuation follows)

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